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FULL PAPER

8-Prenylflavanones via Microwave Promoted Tandem Claisen Rearrangement/6-*endo*-trig Cyclization and Cross Metathesis

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Abstract: Prenylated flavanones were obtained from *ortho*-allyloxy chalcones via a one-pot sequence of Claisen rearrangement and 6-*endo*-trig cyclization, followed by olefin cross metathesis of the intermediate allyl flavanones with 2-methyl-2-butene. The synthetic utility of this route is illustrated for the synthesis of several naturally occurring prenyl flavanones.

Introduction

Prenylated flavanones (**Figure 1**) are secondary metabolites isolated mainly from medicinal plants of the families *Moraceae*, *Cannabaceae* and *Leguminosae*.[1-2] Bioactivities of these compounds such as antibacterial and anti-oxidant activity, cytotoxicity and estrogenic activity modulation, have been summarized and discussed in several recent reviews.[3-6] Prenyl substituents generally increase the bioactivities of flavonoids. This has been attributed to an enhanced membrane permeability, which is caused by the higher lipophilicity compared to the analogous non-prenylated natural products.[7] Due to the beneficial effects of prenyl flavonoids on human health they are regarded as nutraceuticals,[8] which has recently resulted in efforts to produce these compounds through metabolic engineering. These studies[9-10] were mainly focused on prenylnaringenin and the isoflavonoid prenylgenistein, which are potent phytoestrogens that may help to reduce the negative effects of menopause.[11]

Chemical syntheses of prenyl flavonoids[12] are particularly relevant when enzymatic routes via metabolic engineering are not (or not yet) available, or if a flexible access to analogues of natural products is required, e. g. with the aim to investigate structure-activity relationships. For the introduction of the prenyl substituent to the aromatic core Jain's method, i. e. the reaction of phenols with prenyl bromide under basic conditions or with 2-methyl-3-butene-2-ol under Lewis-acidic conditions, has been widely used.[12-13] This reaction is, however, often accompanied by the formation of dual *C*-prenylated and *O*-prenylated products and is limited to very electron rich aromatic systems.[14] Nevertheless many prenyl flavonoids have been synthesized starting from *C*-prenylated acetophenones (synthesized using Jain's method), which were reacted with benzaldehydes in a Claisen-Schmidt-condensation to chalcones. In a separate step the chalcones underwent base-catalyzed 6-*endo*-trig cyclization to give the prenyl flavonoids.[14-18]

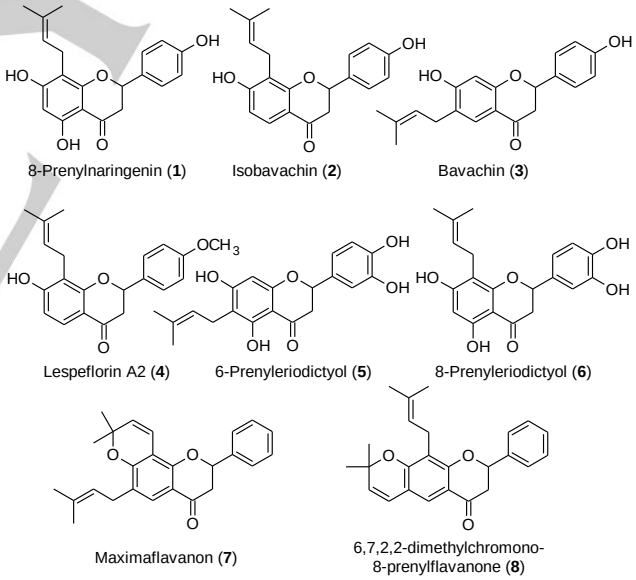


Figure 1. Examples of naturally occurring prenyl flavonoids.

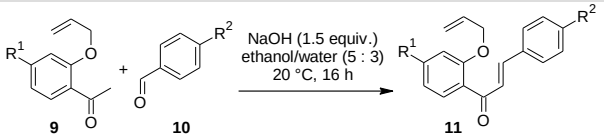
We have previously developed a microwave promoted tandem sequence for the synthesis of 8-allyl substituted chromones starting from *ortho*-allyloxyaryl-alkinyl ketones via Claisen-rearrangement and 6-endo-dig-cyclization.[19] With *ortho*-allyloxy-alk*en*yl ketones, 8-allyl-chroman-4-ones were obtained in a 6-endo-trig-cyclization. The substrate scope was found to be rather limited, because good yields were only obtained for 2,2-dimethylchroman-4-ones, whereas the isolated yields of 8-allyl-flavanones, chroman-4-ones with an aryl substituent at position

C2, remained low.[20] The relevance of prenylated flavanones for natural product chemistry prompted us to revisit the microwave-promoted tandem approach as a route to this substance class. Investigations into the optimization of reaction conditions and application of the method to the synthesis of naturally occurring prenylated flavonoids are discussed herein.

Results and Discussion

The *ortho*-allyloxy chalcones required as starting materials for the microwave promoted tandem sequence were synthesized via Claisen-Schmidt condensation[21] of *O*-allyl salicylic aldehydes **9a**[20] or **9b**[22] and benzaldehydes **10a**-**f**. The products **11** were mostly obtained in very high yields (**Table 1**).

Table 1. Synthesis of *ortho*-allyloxy chalcones **10**.

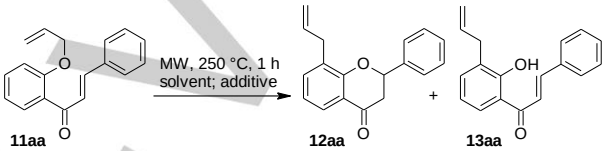


entry	**9**	R^{1} [a]	**10**	R^{2} [a]	**11**[b]	Yield [%]
1	**9a**	H	**10a**	H	**11aa**[20]	98
2	**9b**	OMOM	**10a**	H	**11ba**	Quant.
3	**9a**	H	**10b**	OCH_3	**11ab**	62
4	**9a**	H	**10c**	Br	**11ac**	82
5	**9a**	H	**10d**	Cl	**11ad**[20]	81
6	**9a**	H	**10e**	NO_2	**11ae**	58
7	**9b**	OMOM	**10b**	OCH_3	**11bb**	95
8	**9b**	OMOM	**10c**	Br	**11bc**	96
9	**9b**	OMOM	**10d**	Cl	**11bd**	97
10	**9b**	OMOM	**10f**	OMOM	**11bf**	84

[a] OMOM: OCH_2OCH_3. [b] References with spectroscopic data of the compound.

The reaction conditions for the envisaged microwave promoted tandem sequence were optimized for chalcone **11aa** (**Table 2**). Under the standard conditions previously established for tandem Claisen-rearrangement/6-endo-trig cyclization sequences with other substrates we found that the Claisen-rearrangement step proceeds quantitatively, but that the subsequent 6-endo-trig cyclization stops at ca 50% conversion. This results in the formation of a 1:1 mixture of the desired chroman-4-one **12aa** and allyl chalcone **13aa** (entry 1). Increasing the reaction temperature or the reaction time did not improve the yield of **12aa** (entries 2 and 3). We then tested a variety of Lewis-acidic[23-24] or basic additives[25] that were previously reported to promote intramolecular oxa-Michael-additions (entries 4 - 9), but to no avail. At this point we suspected that the proven solvent for the first step of the microwave promoted tandem sequence, *N*,*N*-diethylaniline, is less suitable for the second step, the oxa-Michael addition. In previous reports on the synthesis of simple flavanones from chalcones polar-protic solvents, in particular methanol, have been used, either in combination with a base[26] or with an acid.[23] For these reasons a modification of the one-pot sequence by a solvent switch between the reaction steps was investigated: removal of *N*,*N*-diethylaniline after the first period of microwave irradiation was accomplished by extraction with diluted hydrochloric acid. The residue was then re-dissolved in methanol and heated in the presence of NaOAc under conventional heating conditions (oil bath, 12 h) to give 8-allyl-2-phenyl-flavane-4-one (**12aa**) in a notably higher yield of 68% (entry 10). These conditions are, however, rather impractical because removal of the *N*,*N*-diethylaniline by aqueous acidic extraction is quite laborious and not compatible with acid-sensitive functionalities or protecting groups.

Table 2. Optimization of conditions for one-pot Claisen-rearrangement / 6-endo-trig-cyclization.



entry	Solvent[a]	Additive (equiv.)	Yield of **12aa** [%]	Yield of **13aa** [%]
1	*N*,*N*-DEA	--	42	43
2[b]	*N*,*N*-DEA	--	32	--[c]
3[d]	*N*,*N*-DEA	--	42	--[c]
4	*N*,*N*-DEA	CuI (1)	41	43
5	*N*,*N*-DEA	piperidine (0.05)	42	--[c]
6	*N*,*N*-DEA	piperidine (1)	21	--[c]
7	*N*,*N*-DEA	NaOAc (1)	33	--[c]
8	*N*,*N*-DEA	$AlCl_3$ (1)	12	--[c]
9[e]	*N*,*N*-DEA	NaOAc (10)	44	42
10[f]	*N*,*N*-DEA	NaOAc (10)	68	19
11	toluene	--	41	52
12[g]	toluene	NaOAc (10)	40	45
13[h]	toluene	NaOAc (10)	68	11
14[i]	toluene	NaOAc (10)	67	12
15[j]	methanol	--	15	5
16[k]	methanol	NaOAc (10)	2	11
17[l]	cyrene	--	14	22
18[m]	cyrene	NaOAc (10)	--	--

[a] *N*,*N*-DEA: *N*,*N*-diethylaniline. [b] T = 270 °C. [c] not determined. [d] t = 2 h. [e] NaOAc added after microwave irradiation, and mixture was stirred at 20 °C for 12 h. [f] Solvent was removed by extraction with HCl (aq.), residue was re-dissolved in methanol (6 mL/mmol), NaOAc (10 equiv.) was added and the mixture was stirred at 65 °C for 12 h. [g] NaOAc added after MW-irradiation for 1 h at 250 °C, then MW-irradiation for 1 h at 100 °C. [h] Solvent was evaporated after MW-irradiation; residue was re-dissolved in methanol (6 mL/mmol);

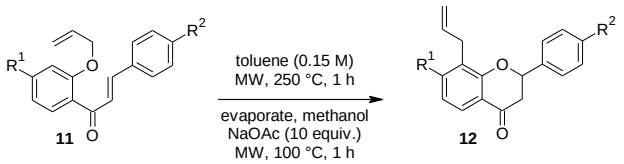
NaOAc (10 equiv.) was added and heated at 65 °C for 12 h. [i] Solvent was evaporated after MW-irradiation; residue was re-dissolved in methanol (6 mL/mmol); NaOAc (10 equiv.) was added; MW-irradiation for 1 h at 100 °C. [j] Allowed max. pressure (30 bar) reached at 180 °C; **11aa** (73%) was recovered. [k] Allowed max. pressure (30 bar) reached at 180 °C; **11aa** (42%) was recovered. [l] Unreacted starting material **11aa** was formed but not quantified. [m] Sharp increase of pressure (> 40 bar) after 8 min of reaction time led to automatic shutdown; complex mixture of products.

For these reasons we sought an alternative solvent that could be removed by simple evaporation after the first step but should still have a sufficiently high boiling point to allow overheating (> 200 °C) without exceeding the allowed maximum pressure. Toluene is a non-polar solvent with a very low dielectric loss tangent (tan δ = 0.040), which means that it is nearly transparent for microwave irradiation. It would normally be considered to be less suitable for microwave chemistry, because its heating efficiency is low.[27] Nevertheless, toluene and other non-polar solvents can be used in microwave-promoted transformations if the reactants are polar and present at sufficiently high concentrations,[28] or if passive heating elements are added.[29] Microwave transparent solvents can even be advantageous because they allow a specific absorption by the reactants.[30] Indeed, microwave irradiation of chalcone **11aa** in toluene at 250 °C for 1 h resulted in the formation of **12aa** and **13aa** in a ratio of 0.8 : 1.0 and a combined yield of 93% (entry 11), which is even higher than the yield obtained in *N*,*N*-DEA under otherwise identical conditions (entry 1). Addition of NaOAc did not improve the yield of the flavanone (entry 12). A solvent switch to methanol in combination with added base, however, led to a yield of 68% of **12aa** under conventional heating conditions (entry 13). The reaction time of the oxa-Michael addition can be drastically reduced from 12 h to 1 h if this step is also conducted under microwave conditions at 100°C (entry 14). Attempts to avoid the solvent switch by performing the entire sequence in methanol failed both under non-basic (entry 15) and basic conditions (entry 16), because the highest attainable temperature with the test substrate was 180 °C at an allowed maximum pressure (30 bar). This temperature is to low to promote the Claisen rearrangement effectively. Recently, dihydrolevoglucosenone, also known under the trade name cyrene®, has attracted considerable attention as a non-toxic biobased polar aprotic solvent with a very high boiling point (T = 203 °C).[31] Although it has found several applications as a reaction medium[32] or for liquid-liquid extractions[33] it has apparently not been used as a solvent for microwave accelerated reactions thus far and no information about the stability under these conditions is available. In general, information about the stability of cyrene under various conditions is scarce. The solvent has been reported to be stable towards weak acids and bases according to the manufacturers product information sheet, but undergoes decomposition in the presence of stronger bases, such as KOH.[34] Microwave irradiation of chalcone **11aa** in cyrene furnished the Claisen-rearrangement products **12aa** and **13aa** in only 36% combined yield and an unsatisfactory product ratio (entry 17), but the solvent appears to be stable at this temperature over a period of one hour. When the test reaction was run in the presence of NaOAc a sharp increase of the internal pressure to 40 bar, which is well beyond the allowed maximum pressure, was observed after a few minutes, which led to an automatic shutdown of the microwave reactor. In summary, neither methanol nor cyrene appear to be suitable solvents for conducting the one-pot Claisen-rearrangement/6-endo-trig cyclization sequence and we therefore resumed to the conditions listed in entry 14.

The results summarized in **Table 3** show that these optimized reaction conditions can be applied to a variety of substituted *ortho*-allyloxy chalcones **11** to give, in total, ten 8-allyl-flavan-4-ones **12** in fair to good yields using the standard protocol.

In the next step the conversion of the 8-allyl-flavan-4-ones **12** to their 8-prenyl derivatives **14** via olefin cross metathesis (CM) was investigated.[35] Construction of α,α-dimethylsubstituted C-C-double bonds by olefin cross metathesis was first reported by Grubbs and co-workers, who found that 2-methyl-2-butene is far more reactive than 2,3-dimethyl-2-butene and more conveniently to handle than isobutene, which is a gas at ambient temperature.[36] According to Grubbs' general selectivity model for cross metathesis reactions,[37] our 8-allyl-flavan-4-ones **12** are Type I olefins (sterically unhindered, electronically neutral, undergo fast self metathesis in the absence of other CM partners), whereas 2-methyl-2-butene is a Type III olefin (sterically hindered, does not undergo self metathesis, but can react with other olefins). The combination of Type I and Type III olefins in CM is generally expected to proceed selectively. With 2-methyl-2-butene as CM partner of a Type I olefin a Ru-ethylidene is the propagating species, rather than a Ru-isopropylidene, due to lower steric hindrance in the ruthenacyclobutane intermediate. This explains why CM reactions of allyl groups with 2-methyl-2-butene can be expected to give α,α-dimethylallyl- rather than crotyl-substituted products.[36] The cross metathesis approach has been used in some total syntheses of natural products, including prenylated flavonoids[38-39] and coumarins.[22, 40-42] We used two different protocols for the synthesis of 8-prenylflavonoids from their 8-allyl counterparts (**Table 4**). Allyl flavonoids **12** without OMOM-substituents were reacted with 2-methyl-2-butene in the presence of second generation Grubbs' catalyst[43] (**A**) at ambient temperature. Starting materials **12** with MOM-protected OH groups (entries 2 and 7 – 10) underwent cross metathesis under the same conditions, but were treated with methanol in the presence of HCl (aq.) immediately after the CM to cleave off the protecting group without isolation of the MOM-protected intermediates. For the one-pot CM-deprotection protocol slightly lower isolated yields (62% - 77%) were obtained compared to the CM conditions without *in situ* deprotection (entries 1 and 3 – 6, 84% - quant.).

Table 3. Synthesis of 8-allyl-2-arylflavan-4-ones **12**.



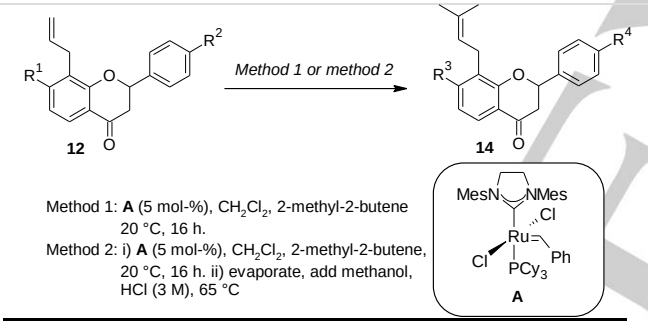
entry	**11**	R^{1} [a]	R^{2} [a]	**12**[b]	Yield [%]
1	**11aa**	H	H	**12aa**[20]	67
2	**11ba**	OMOM	H	**12ba**	46
3	**11ab**	H	OCH_3	**12ab**[44]	66
4	**11ac**	H	Br	**12ac**	76
5	**11ad**	H	Cl	**12ad**[20]	53
6	**11ae**	H	NO_2	**12ae**	66

7	**11bb**	OMOM	OCH_3	**12bb**	62
8	**11bc**	OMOM	Br	**12bc**	48
9	**11bd**	OMOM	Cl	**12bd**[45]	50
10	**11bf**	OMOM	OMOM	**12bf**[45]	60

[a] OMOM: OCH_2OCH_3. [b] References reporting spectroscopic data of the compound.

Out of the ten 8-prenyl flavonoids listed in Table 4 six have not been described in the literature so far. Compound **14aa** (entry 1) is a synthetic 8-prenylflavonoid that was tested for its nematicidal activity.[46] 7-Hydroxy-8-(γ,γ-dimethylallyl)-flavanone (entry 2, **14ba**) was first isolated from *Milletia ovalifolia* seeds[47] and later from the pods of *Tephrosia falciformis*.[48] It was demonstrated that **14ba** is one of the most potent inhibitors of adenosine cyclic monophosphate (cAMP) phosphodiesterase out of more than sixty flavonoids tested.[49] Lespeflorin A_2 (**4**) was isolated from the roots of the plant *Lespedeza floribunda* Bunge and found to inhibit melanin synthesis (entry 7).[50] Isobavachin (**2**) was isolated from *Psoralea corylifolia* seeds[51] and shows antioxidative activities.[52] This compound has previously been synthesized via *C*-prenylation of a substituted acetophenone, as outlined in the introduction, to obtain a sufficient quantity to determine its estrogenic potency.[16]

Table 4. Synthesis of 8-prenyl-2-arylflavan-4-ones **14** via cross metathesis.

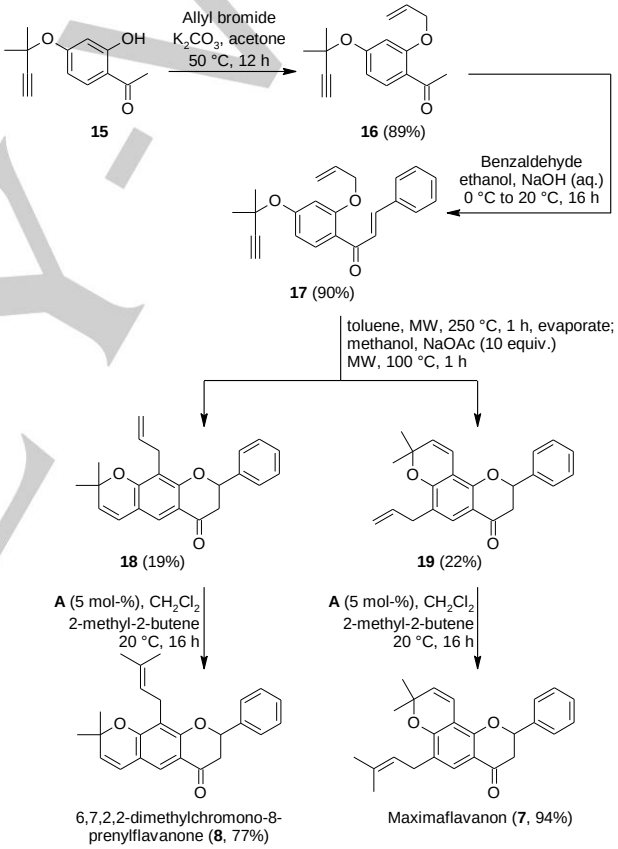


Method 1: **A** (5 mol-%), CH_2Cl_2, 2-methyl-2-butene 20 °C, 16 h.
Method 2: i) **A** (5 mol-%), CH_2Cl_2, 2-methyl-2-butene, 20 °C, 16 h. ii) evaporate, add methanol, HCl (3 M), 65 °C

entry	**12**	R^3	R^4	**14**[c]	Yield [%]
1[a]	**12aa**	H	H	**14aa**[46]	84
2[b]	**12ba**	OH	H	**14ba**[47]	73
3[a]	**12ab**	H	OCH_3	**14ab**	95
4[a]	**12ac**	H	Br	**14ac**	Quant.
5[a]	**12ad**	H	Cl	**14ad**	89
6[a]	**12ae**	H	NO_2	**14ae**	91
7[b]	**12bb**	OH	OCH_3	**4**[50]	77
8[b]	**12bc**	OH	Br	**14bc**	68
9[b]	**12bd**	OH	Cl	**14bd**	62
10[b]	**12bf**	OH	OH	**2**[16]	62

[a] Method 1. [b] Method 2. [c] References reporting spectroscopic data of the compound.

We then investigated if the sequence of microwave promoted Claisen-rearrangement/oxa-Michael addition and olefin cross metathesis can also be applied to obtain more complex flavonoids with two prenyl groups. We aimed at a synthesis that would allow the installation of both prenyl substituents (or their allyl precursors) in one microwave promoted step. As an exemplary target structure we chose 6,7,2,2-dimethylchromono-8-prenylflavan-4-one (**8**). This linear prenylated chromonoflavonoid has been isolated from the leaves[53] and bark[54] of *Lannea acida*, a tree indigenous in North Nigeria that plays an important role in traditional medicine to treat inflammation and fever. The same natural product was later isolated from the stem bark of the tree *Pongamia pinnata*, a medicinal plant found in Southeast Asia and Australia.[55-56] Although **8** has only one actual prenyl substituent it is nevertheless a double prenylated flavonoid, because the chromene part is biosynthetically derived from an *ortho*-prenyl phenol through a cyclase catalysed cyclization.[57-58]



Scheme 1. Synthesis of 6,7,2,2-dimethylchromono-8-prenylflavan-4-one (**8**) and maximaflavanone A (**7**).

For the chemical synthesis of chromenes we[59] and others[60] have used a microwave promoted propargyl-Claisen rearrangement, a transformation that starts from propargyl ethers and proceeds through allene intermediates.[61] To install the chromene part and the 8-allyl substituent simultaneously in the microwave promoted tandem sequence, the chalcone **17**, bearing a propargyl and an allyl ether, was required as a starting material (**Scheme 1**). This compound was synthesized in two steps from **15**[59] via *O*-allylation and subsequent Claisen-Schmidt condensation of **16** and benzaldehyde. Submission of **17** to the

optimized conditions for the microwave promoted Claisen-rearrangement/6-endo-cyclization furnished a 1:1 mixture of the desired linear product **18** and its angular isomer **19**. The formation of **19** suggests that the propargyl Claisen rearrangement is not regioselective and notably faster than the allyl Claisen rearrangement. Once the propargyl Claisen rearrangement has occurred in position 8, this site is blocked for the allyl substituent. In such situations allyl ethers are known to undergo two successive [3,3]-sigmatropic rearrangements, first a Claisen-rearrangement and then a Cope-rearrangement. Via this sequence the allyl group ultimately migrates to the *para*-position,[62-63] which is position 6 in flavonoid **19**. The linear isomer **18** and the angular isomer **19** are not easily distinguishable by their one-dimensional NMR-spectra. For these reasons a full signal assignment was performed based on the two-dimensional NMR-spectroscopic methods H,H-COSY, HSQC and HMBC. Indicative for the linear structure of **18** and the angular structure of **19** are the HMBC correlations shown in **Figure 2**.

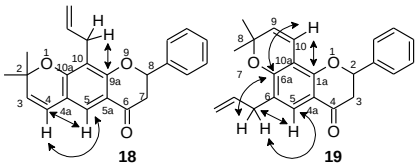
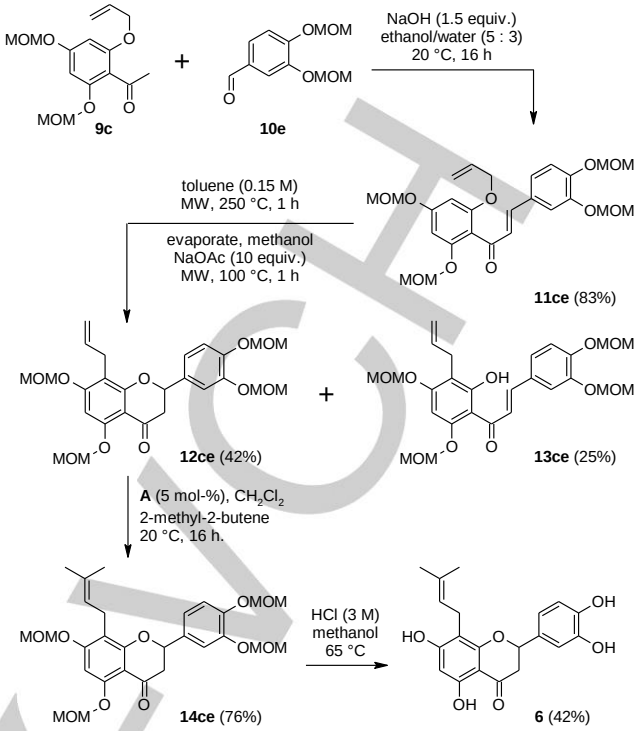


Figure 2. HMBC-experiments for isomers **18** and **19**.

Gratifyingly, the formation of **19** enabled the synthesis of another natural product, maximaflavanone A (**7**), which is the angular regioisomer of **8**. Maximaflavanone A (**7**) was first isolated from the roots of the medicinal plant *Tephrosia maxima* Pers[64] and later from the roots of *Pongamia pinnata*,[65] which is also a source of the linear natural product **8**. We are aware of one previous synthesis of maximaflavanone A (**7**) that starts from a preformed 5-prenyloxy substituted chromene.[66] To complete the syntheses of **7** and **8** the products **18** and **19** of the microwave promoted tandem sequence were separated, which was conveniently achieved by chromatography due to their significantly different polarities. Olefin cross metathesis of **18** and **19** with 2-methyl-2-butene in the presence of second generation Grubbs' catalyst **A** proceeded in 77% yield with **18** and in 94% yield with **19**. The natural products 6,7,2,2-dimethylchromono-8-prenylflavan-4-one (**8**) and maximaflavanone A (**7**) were obtained over four steps in 11.7% and 16.6% total yield.

As an example for a 5-hydroxylated 8-prenylflavanone we investigated the synthesis of 8-prenyleriodictyol (**6**) along the synthetic route outlined herein (**Scheme 2**).



Scheme 2. Synthesis of 8-prenyleriodictyol (**6**).

8-Prenyleriodictyol (**6**) was first isolated from the flowering plant *Wyethia helenioides*.[67] It shows moderate vasorelaxant and neuroprotective activities,[17] and antibiotic activities against *Staphylococcus aureus* and *Staphylococcus epidermis* in the range of 12.5 to 25 μg/mL.[68] The compound has previously been synthesized through oxa-Michael cyclization of a prenylated chalcone[17] and via regioselective enzyme catalyzed prenylation of eriodictyol.[69] Our synthesis started with the known compounds **9c**[70] and **10e**,[71] which were reacted in a Claisen-Schmidt condensation under the previously established conditions to furnish **11ce**. Microwave promoted tandem Claisen-rearrangement/6-endo-cyclization of **11ce** gave a separable mixture of MOM-protected flavanone **12ce** and uncyclized chalcone **13ce** in a combined yield of 67%. After separation by column chromatography, **12ce** was subjected to cross metathesis with 2-methyl-2-butene to yield MOM-protected 8-prenyleriodictyol **14ce**, which was eventually deprotected to give 8-prenyleriodictyol (**6**) in four steps and 11.1% overall yield. All analytical data obtained for synthetic 8-prenyleriodictyol (**6**) match those previously reported for the natural product.[67, 69]

Conclusion

In summary, we report a synthesis of 8-prenylflavanones that relies on a microwave promoted tandem sequence comprising a Claisen-rearrangement and an oxa-Michael cyclization in combination with a highly regioselective olefin cross metathesis reaction using 2-methyl-2-butene to construct the prenyl substituent. The method was applied to the synthesis of various naturally occurring 8-prenylflavanones, including 6,7,2,2-dimethylchromono-8-prenylflavan-4-one and its angular isomer maximaflavanone A.

Experimental Section

General methods: all experiments involving air- and moisture sensitive compounds were conducted in dry reaction vessels under an atmosphere of dry nitrogen. The solvents dichloromethane, diethyl ether, methanol and toluene were purified using an MBraun solvent purification system. Solvents for chromatography were distilled prior to use. All reagents were purchased and used without further purification, unless otherwise stated, or synthesized following published procedures. ^{1}H NMR spectra were obtained in $CDCl_3$ with $CHCl_3$ (δ = 7.26) as an internal standard. Multiplicities are denoted as s (singlet), d (doublet), t (triplet), q (quartet) and m (multiplet). Coupling constants are given in Hz. ^{13}C NMR spectra were recorded with proton decoupling in $CDCl_3$ with $CDCl_3$ (δ = 77.16) as an internal standard. Whenever the solubility or stability of the sample or signal separation were insufficient in $CDCl_3$, it was replaced by [D_6]acetone ([D_5]acetone as internal standard for ^{1}H NMR spectroscopy, δ = 2.05 ppm, [D_6]acetone as internal standard for ^{13}C NMR spectroscopy, δ = 29.8 ppm) or [D_4]methanol (CD_2HOD as internal standard for ^{1}H NMR spectroscopy, δ = 3.31 ppm, [D_4]methanol as internal standard for ^{13}C NMR spectroscopy, δ = 49.2 ppm). IR measurements were carried out as ATR-FTIR spectra. Wavenumbers ($\tilde{\nu}$) are given in cm^{-1} and the peak intensities are denoted as: strong (s), medium (m), weak (w). High-resolution mass spectra were obtained by ESI-TOF or EI-TOF. Microwave reactions were carried out in an Anton-Paar-monowave-300 or an Anton-Paar-monowave-400 reactor (monowave, maximum power 850 W, temperature control by IR-sensor, vial volume 20 mL). These starting materials were synthesized following literature procedures: **9a**,[20] **9b**,[22] **9c**[70] and **10e**.[71]

General procedure for the synthesis of chalcones 11: A solution of the appropriate acetophenone **9** (1.00 mmol) and the appropriate benzaldehyde **10** (2.00 mmol) in ethanol (0.5 mL) was cooled to 0 °C. A solution of NaOH (59 mg, 1.50 mmol) in water (0.26 mL) was added over a period of 10 min. The mixture was warmed to ambient temperature and stirred for 12 h. An aqueous solution of HCl (1 M, 1.00 mL) was added and the mixture was diluted with MTBE (10 mL). The aqueous layer was separated, extracted with MTBE (twice, 10 mL each) and the combined organic extracts were dried with $MgSO_4$, filtered and evaporated. The residue was purified by chromatography on silica, using hexanes/MTBE mixtures of increasing polarity as eluent, to furnish the chalcones **11**.

(*E*)-1-(2-Allyloxyphenyl)-3-phenylprop-2-en-1-on (11aa):[20] following the general procedure, **9a** (176 mg, 1.00 mmol) and **10a** (212 mg, 2.00 mmol) were converted to **11aa** (259 mg, 0.98 mmol, 98%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.70 – 7.55 (m, 4H), 7.51 – 7.34 (m, 5H), 7.05 (td, *J* = 7.6, 1.0 Hz, 1H), 6.99 (d, *J* = 8.5 Hz, 1H), 6.04 (ddt, *J* = 15.6, 10.2, 5.0 Hz, 1H), 5.42 (dq, *J* = 17.3, 1.6 Hz, 1H), 5.25 (dq, *J* = 10.6, 1.5 Hz, 1H), 4.64 (d, *J* = 5.0 Hz, 2H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 192.8, 157.6, 142.9, 135.3, 133.0, 132.8, 130.7, 130.3, 129.9, 129.0, 128.5, 127.4, 121.2, 117.9, 113.2, 69.5 ppm; IR $\tilde{\nu}$ = 3026 (w), 1658 (m), 1600 (s), 1482 (m), 1448 (s), 1331 (m), 1289 (m), 1236 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{16}O_2$ [M$^+$] 264.1150; found 264.1158.

(*E*)-1-(2-(Allyloxy)-4-(methoxymethoxy)phenyl)-3-phenylprop-2-en-1-on (11ba): following the general procedure, **9b** (236 mg, 1.00 mmol) and **10a** (212 mg, 2.00 mmol) were converted to **11ba** (324 mg, 1.00 mmol, quant.): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.76 (d, *J* = 8.6 Hz, 1H), 7.70 (d, *J* = 15.8 Hz, 1H), 7.63 – 7.55 (m, 3H), 7.40 – 7.35 (m, 3H), 6.72 (d, *J* = 8.6 Hz, 1H), 6.65 (s, 1H), 6.05 (ddt, *J* = 15.7, 10.3, 5.1 Hz, 1H), 5.45 (d, *J* = 17.3 Hz, 1H), 5.27 (d, *J* = 10.6 Hz, 1H), 5.22 (s, 2H), 4.62 (d, *J* = 4.9 Hz, 2H), 3.49 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 190.7, 161.8, 159.4, 142.0, 135.5, 132.8. 132.5, 130.0, 128.9, 128.4, 127.4, 123.5, 118.2, 108.4, 101.4, 94.4, 69.6, 56.3 ppm; IR (ATR) $\tilde{\nu}$ = 2902 (w), 1652 (m), 1603 (s), 1494 (m), 1448 (m), 1421 (m), 1330 (m), 1246 (m), 1151 (s), 986 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{20}O_4$ [M$^+$] 324.1362; found 324.1376.

(*E*)-1-(2-Allyloxyphenyl)-3-(4-methoxyphenyl)prop-2-en-1-on (11ab): following the general procedure, **9a** (176 mg, 1.00 mmol) and **10b** (272 mg, 2.00 mmol) were converted to **11ba** (182 mg, 0.62 mmol, 62%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.65 (dd, *J* = 7.6, 1.8 Hz, 1H), 7.62 (d, *J* = 15.9 Hz, 1H), 7.54 (d, *J* = 8.7 Hz, 2H), 7.45 (ddd, *J* = 8.3, 7.4, 1.8 Hz, 1H), 7.33 (d, *J* = 15.9 Hz, 1H), 7.04 (td, *J* = 7.5, 1.0 Hz, 1H), 6.98 (d, *J* = 8.3 Hz, 1H), 6.90 (d, *J* = 8.8 Hz, 1H), 6.03 (ddt, *J* = 17.2, 10.5, 5.0 Hz, 1H), 5.42 (dm, *J* = 17.2 Hz, 1H), 5.24 (dm, *J* = 10.5 Hz, 1H), 4.64 (dm, *J* = 5.0 Hz, 2H), 3.83 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 192.9, 161.6, 157.2, 143.0, 132.8, 132.7, 130.6, 130.2, 130.1, 128.0, 125.2, 121.1, 117.7, 114.5, 113.1, 69.5, 55.5 ppm; IR (ATR) $\tilde{\nu}$ = 2934 (w), 2838 (w), 1655 (m), 1596 (s), 1507 (s), 1482 (m), 1447 (m), 1422 (m), 1330 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{19}H_{18}O_3$ [M$^+$] 294.1256; found 294.1265.

(*E*)-1-(2-Allyloxyphenyl)-3-(4-bromophenyl)prop-2-en-1-on (11ac): following the general procedure, **9a** (176 mg, 1.00 mmol) and **10c** (366 mg, 2.00 mmol) were converted to **11ac** (281 mg, 0.82 mmol, 82%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.67 (dd, *J* = 7.6, 1.7 Hz, 1H), 7.58 (d, *J* = 15.9 Hz, 1H), 7.53 – 7.39 (m, 6H), 7.04 (td, *J* = 7.5, 1.0 Hz, 1H), 6.97 (d, *J* = 8.3 Hz, 1H), 6.02 (ddt, *J* = 17.2, 10.2, 5.0 Hz, 1H), 5.41 (dm, *J* = 17.2 Hz, 1H), 5.24 (dm, *J* = 10.2 Hz, 1H), 4.62 (dm, *J* = 5.0 Hz, 2H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 192.2, 157.4, 141.1, 134.2, 133.2, 132.7, 132.2, 130.8, 129.8, 129.5, 127.8, 124.4, 121.2, 117.9, 113.1, 69.4 ppm; IR (ATR) $\tilde{\nu}$ = 3074 (w), 1656 (m), 1602 (s), 1484 (s), 1448 (s), 1401 (m), 1323 (m), 1235 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}{}^{79}BrO_2$ [M$^+$] 342.0255; found 342.0263.

(*E*)-1-(2-Allyloxyphenyl)-3-(4-chlorphenyl)prop-2-en-1-on (11ad):[20] following the general procedure, **9a** (176 mg, 1.00 mmol) and **10d** (280 mg, 2.00 mmol) were converted to **11ad** (241 mg, 0.81 mmol, 81%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.67 (dd, *J* = 7.6, 1.9 Hz, 1H), 7.60 (d, *J* = 15.9 Hz, 1H), 7.53 – 7.41 (m, 4H), 7.35 (d, *J* = 8.5 Hz, 2H), 7.05 (td, *J* = 7.5, 1.0 Hz, 1H), 6.99 (d, *J* = 8.3 Hz, 1H), 6.03 (ddt, *J* = 17.2, 10.3, 5.0 Hz, 1H), 5.41 (dm, *J* = 17.2 Hz, 1H), 5.25 (dm, *J* = 10.3 Hz, 1H), 4.64 (dm, *J* = 5.0 Hz, 2H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 192.4, 157.4, 141.2, 136.2, 133.9, 133.2, 132.7, 130.8, 129.6, 129.3, 127.8, 121.3, 118.2, 117.9, 113.1, 69.5 ppm; IR (ATR) $\tilde{\nu}$ = 3073 (w), 1656 (m), 1602 (s), 1483 (s), 1448 (s), 1405 (w), 1324 (s), 1283 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}{}^{35}ClO_2$ [M$^+$] 298.0761; found 298.0771.

(*E*)-1-(2-Allyloxyphenyl)-3-(4-nitrophenyl)prop-2-en-1-on (11ae): following the general procedure, **9a** (176 mg, 1.00 mmol) and **10e** (302 mg, 2.00 mmol) were converted to **11ae** (179 mg, 0.58 mmol, 58%): yellowish solid; mp = 113 - 115 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 8.23 (d, *J* = 8.9 Hz, 2H), 7.74 – 7.63 (5H), 7.49 (ddd, *J* = 8.4, 7.4, 1.8 Hz, 1H), 7.04 (td, *J* = 7.5, 1.0 Hz, 1H), 7.00 (d, *J* = 8.4 Hz, 1H), 6.04 (ddt, *J* = 17.2, 10.4, 5.1 Hz, 1H), 5.42 (dm, *J* = 17.2 Hz, 1H), 5.27 (dm, *J* = 10.4 Hz, 1H), 4.65 (dm, *J* = 5.1 Hz, 2H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 191.6, 157.7, 148.5, 141.7, 139.0, 133.9, 132.6, 131.1, 131.0, 129.0, 128.9, 124.2, 121.4, 118.2, 113.1, 69.6 ppm; IR (ATR): $\tilde{\nu}$ = 3108 (w), 3077 (w), 2869 (w), 1658 (m), 1595 (s), 1509 (s), 1481 (m), 1450 (m), 1424 (w), 1335 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}O_3N$ [M$^+$] 309.1001; found 309.1011.

(*E*)-1-(2-(Allyloxy)-4-(methoxymethoxy)phenyl)-3-(4-methoxyphenyl)-prop-2-en-1-on (11bb): following the general procedure, **9b** (236 mg, 1.00 mmol) and **10b** (272 mg, 2.00 mmol) were converted to **11bb** (336 mg, 0.95 mmol, 95%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.72 (d, *J* = 8.6 Hz, 1H), 7.66 (d, *J* = 15.8 Hz, 1H), 7.53 (d, *J* = 8.8 Hz, 2H), 7.45 (d, *J* = 15.8 Hz, 1H), 6.90 (d, *J* = 8.7 Hz, 2H), 6.71 (dd, *J* = 8.6, 2.1 Hz, 1H), 6.64 (d, *J* = 2.0 Hz, 1H), 6.05 (ddt, *J* = 15.7, 10.2, 5.1 Hz, 1H), 5.45 (dm, *J* = 17.3 Hz, 1H), 5.27 (dm, *J* = 10.6 Hz, 1H), 5.21 (s, 2H), 4.62 (d, *J* = 5.0 Hz, 2H), 3.84 (s, 3H), 3.49 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 190.8, 161.6, 161.4, 159.2, 142.1, 132.7, 132.6, 130.1, 128.3, 125.3, 123.8, 118.1, 114.4, 108.4, 101.5, 94.5, 69.6, 56.4, 55.5 ppm; IR (ATR): $\tilde{\nu}$ = 2933 (w), 2837 (w), 1650 (m), 1597 (s), 1509 (s), 1421 (m), 1246 (s), 1210 (m), 1170 (s), 1077 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for$C_{21}H_{22}O_5$ [M$^+$] 354.1467; found 354.1477.

(*E*)-1-(2-(Allyloxy)-4-(methoxymethoxy)phenyl)-3-(4-bromophenyl)-prop-2-en-1-on (11bc): following the general procedure, **9b** (236 mg, 1.00 mmol) and **10c** (366 mg, 2.00 mmol) were converted to **11bc** (386 mg, 0.96 mmol, 96%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.75 (d, *J* = 8.6 Hz, 1H), 7.63 (d, *J* = 16.0 Hz, 1H), 7.57 (d, *J* = 16.0 Hz, 1H), 7.50 (d, *J* = 8.6 Hz, 2H), 7.43 (d, *J* = 8.6 Hz, 2H), 6.71 (dd, *J* = 8.6, 2.2 Hz, 1H), 6.64 (d, *J* = 2.1 Hz, 1H), 6.05 (ddt, *J* = 17.2, 10.4, 5.1 Hz, 1H), 5.44 (dm, *J* = 17.2 Hz, 1H), 5.28 (dm, *J* = 10.6 Hz, 1H), 5.21 (s, 2H), 4.62 (d, *J* = 5.1 Hz, 2H), 3.49 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 190.2, 162.0, 159.5, 140.4, 134.6, 132.9, 132.5, 132.2, 129.8, 128.0, 124.2, 123.3, 118.3, 108.5, 101.4, 94.4, 69.6, 56.4 ppm; IR (ATR) $\tilde{\nu}$ = 2926 (w), 1654 (m), 1603 (s), 1486 (m), 1421 (m), 1318 (m), 1247 (m), 1209 (m), 1152 (m), 1071 (m), 1007 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{79}BrO_4$ [M$^+$] 402.0467; found 402.0476.

(*E*)-1-(2-(Allyloxy)-4-(methoxymethoxy)phenyl)-3-(4-chlorophenyl)-prop-2-en-1-on (11bd): following the general procedure, **9b** (236 mg, 1.00 mmol) and **10d** (280 mg, 2.00 mmol) were converted to **11bd** (347 mg, 0.97 mmol, 97%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.75 (d, *J* = 8.6 Hz, 1H), 7.64 (d, *J* = 15.9 Hz, 1H), 7.56 (d, *J* = 15.9 Hz, 1H), 7.52 (d, *J* = 8.6 Hz, 2H), 7.35 (d, *J* = 8.5 Hz, 2H), 6.72 (dd, *J* = 8.6, 2.2 Hz, 1H), 6.64 (d, *J* = 2.1 Hz, 1H), 6.05 (ddt, *J* = 17.2, 10.4, 5.1 Hz, 1H), 5.44 (dm, *J* = 17.3 Hz, 1H), 5.28 (dm, *J* = 10.5 Hz, 1H), 5.22 (s, 2H), 4.62 (d, *J* = 5.1 Hz, 2H), 3.49 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 190.3, 162.0, 159.5, 140.4, 135.9, 134.1, 132.9, 132.5, 129.6, 129.2, 128.0, 123.3, 118.3, 108.5, 101.4, 94.5, 69.6, 56.4 ppm; IR (ATR) $\tilde{\nu}$ = 2927 (w), 1654 (m), 1605 (s), 1490 (m), 1421 (m), 1321 (m), 1247 (m), 1208 (m), 1153 (m), 1079 (m), 1011 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{35}ClO_4$ [M$^+$] 358.0972; found 358.0982.

(*E*)-1-(2-(Allyloxy)-4-(methoxymethoxy)phenyl)-3-(4-(methoxy-methoxy)phenyl)prop-2-en-1-on (11bf): following the general procedure, **9b** (236 mg, 1.00 mmol) and **10f** (332 mg, 2.00 mmol) were converted to **11bf** (323 mg, 0.84 mmol, 84%): yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.73 (d, *J* = 8.6 Hz, 1H), 7.65 (d, *J* = 15.8 Hz, 1H), 7.53 (d, *J* = 8.8 Hz, 2H), 7.46 (d, *J* = 15.8 Hz, 1H), 7.03 (d, *J* = 8.7 Hz, 1H), 6.71 (dd, *J* = 8.6, 2.2 Hz, 1H), 6.64 (d, *J* = 2.1 Hz, 1H), 6.05 (ddt, *J* = 17.1, 10.4, 5.1 Hz, 1H), 5.45 (dm, *J* = 17.3 Hz, 1H), 5.28 (dd, *J* = 10.6 Hz, 1H), 5.21 (s, 2H), 5.20 (s, 2H), 4.62 (d, *J* = 5.1 Hz, 2H), 3.49 (s, 3H), 3.48 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 190.8, 161.6, 159.3, 158.9, 141.9, 132.7, 132.6, 130.0, 129.3, 125.7, 123.7, 118.1, 116.6, 114.4, 108.4, 101.5, 94.4, 94.3, 69.6, 56.4, 56.3 ppm; IR (ATR) $\tilde{\nu}$ = 2901 (w), 1650 (m), 1598 (s), 1508 (s), 1422 (m), 1239 (m), 1207 (m), 1149 (s), 1076 (s), 979 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{22}H_{24}O_6$ [M$^+$] 384.1573; found 384.1571.

1-(2-Allyloxy-4,6-bis(methoxymethoxy)phenyl)-3-(3,4-bis(methoxy-methoxy)-phenyl)-prop-2-en-1-on (11ce): following the general procedure, **9c** (300 mg, 1.00 mmol) and **10e** (452 mg, 2.00 mmol) were converted to **11ce** (420 mg, 0.83 mmol, 83%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.34 (s, 1H), 7.27 (d, *J* = 16.0 Hz, 1H), 7.15 – 7.09 (m, 2H), 6.86 (d, *J* = 16.0 Hz, 1H), 6.49 (d, *J* = 1.9 Hz, 1H), 6.35 (d, *J* = 2.0 Hz, 1H), 5.90 (ddt, *J* = 17.3, 10.3, 5.0 Hz, 1H), 5.30 (dm, *J* = 17.3 Hz, 1H), 5.24 (s, 2H), 5.22 (s, 2H), 5.16 (s, 2H), 5.16 (dm, *J* = 10.3 Hz, 1H), 5.09 (s, 2H), 4.49 (d, *J* = 5.1 Hz, 2H), 3.50 (s, 3H), 3.49 (s, 3H), 3.49 (s, 3H), 3.37 (s, 3H) ppm; ^{13}C NMR (75MHz, $CDCl_3$): δ = 194.2, 159.7, 157.5, 156.0, 149.3, 147.4, 144.5, 132.7, 129.5, 128.0, 123.7, 117.5, 116.2, 116.0, 114.3, 96.3, 95.6, 95.4, 95.2, 94.7, 94.7, 69.4, 56.4, 56.4, 56.3, 56.3 ppm; IR (ATR) $\tilde{\nu}$ = 2955 (w), 2919 (m), 2850 (w), 1648 (w), 1601 (w), 1508 (w), 1464 (w), 1433 (w), 1398 (w), 1256 (w), 1227 (w), 1151 (w), 1126 (w), 1072 (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{26}H_{32}O_{10}$ [M$^+$] 504.1990; found 504.1980.

General procedure for the synthesis of 8-allyl-2-flavanones 12: A solution of the appropriate chalcone **11** (1.00 mmol) in toluene (7 mL) was placed in a vessel suited for microwave irradiation. The vial was sealed, placed in a microwave reactor and irradiated at 250 °C for 1 h. The solvent was evaporated and the residue redissolved in methanol (10 mL). NaOAc (0.82 g, 10.0 mmol) was added, the vial was sealed, again placed in a microwave reactor and irradiated at 100 °C for 1 h. After cooling to ambient temperature water (10 mL) and ethyl acetate (10 mL) were added to the mixture. The organic layer was separated and the aqueous layer was extracted twice with ethyl acetate (10 mL each). The combined organic extracts were dried with $MgSO_4$, filtered and evaporated. The residue was purified by chromatography on silica, using hexanes / MTBE mixtures of increasing polarity as eluents, to furnish the corresponding 8-allyl-flavan-4-ones **12**.

8-Allyl-2-phenylchroman-4-one (12aa):[20] following the general procedure, **11aa** (264 mg, 1.00 mmol) was converted to **12aa** (177 mg, 0.67 mmol, 67%) and **13aa** (32 mg, 0.12 mmol, 12%). *Analytical data of **12aa***: yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.84 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.53 – 7.35 (m, 6H), 7.01 (t, *J* = 7.6 Hz, 1H), 6.06 – 5.91 (m, 1H), 5.50 (dd, *J* = 12.9, 3.3 Hz, 1H), 5.14 – 5.04 (m, 2H), 3.45 (d, *J* = 6.6 Hz, 2H), 3.03 (dd, *J* = 16.8, 12.9 Hz, 1H), 2.95 (dd, *J* = 16.8, 3.4 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 192.4, 159.5, 139.3, 136.4, 136.1, 129.6, 128.9, 128.7, 126.0, 125.3, 121.4, 121.1, 116.4, 79.4, 44.8, 34.0 ppm; IR (ATR) $\tilde{\nu}$ = 3066 (w), 1689 (s), 1595 (s), 1475 (s), 1442 (s), 1298 (s), 1221 (s), 1070 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{16}O_2$ [M$^+$] 264.1150; found 264.1155. *Analytical data of **13aa***:[5] yellowish solid. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 13.19 (s, 1H), 7.92 (d, *J* = 15.5 Hz, 1H), 7.82 (dd, *J* = 8.1, 1.2 Hz, 1H), 7.71 – 7.63 (m, 3H), 7.47 – 7.42 (m, 3H), 7.39 (dm, *J* = 7.4 Hz, 1H), 6.92 (t, *J* = 7.7 Hz, 1H), 6.07 (ddt, *J* = 16.9, 10.3, 6.6 Hz, 1H), 5.16 – 5.09 (m, 2H), 3.48 (d, *J* = 6.6 Hz, 2H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 194.1, 161.8, 145.4, 136.6, 136.3, 134.9, 131.0, 129.8, 129.2, 128.8, 127.9, 120.7, 119.7, 118.5, 116.2, 33.7 ppm; IR (ATR): $\tilde{\nu}$ = 2923 (w), 1636 (s), 1594 (m), 1571 (s), 1476 (m), 1434 (m), 1345 (s), 1305 (m), 1231 (s), 1105 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}O_2$ [M-H]$^+$ 263.1067; found 263.1061.

8-Allyl-7-(methoxymethoxy)-2-phenylchroman-4-one (12ba): following the general procedure, **11ba** (324 mg, 1.00 mmol) was converted to **12ba** (149 mg, 0.46 mmol, 46%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.84 (d, *J* = 8.8 Hz, 1H), 7.51 – 7.37 (m, 5H), 6.84 (d, *J* = 8.9 Hz, 1H), 5.94 (ddt, *J* = 16.3, 10.1, 6.3 Hz, 1H), 5.47 (dd, *J* = 12.6, 3.5 Hz, 1H), 5.27 (s, 2H), 5.06 – 4.94 (m, 2H), 3.48 (s, 3H), 3.48 (d, *J* = 6.3 Hz, 2H), 3.01 (dd, *J* = 16.8, 12.6 Hz, 1H), 2.88 (dd, *J* = 16.8, 3.6 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$) δ = 191.4, 161.0, 160.6, 139.4, 135.9, 128.9, 128.6, 126.6, 125.9, 117.0, 116.0, 115.0, 107.9, 94.1, 79.5, 56.5, 44.6, 27.5 ppm; IR (ATR) $\tilde{\nu}$ = 2906 (w), 1682 (s), 1596 (s), 1435 (m), 1256 (s), 1154 (m), 1110 (m), 1036 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{20}O_4$ [M$^+$] 324.1362; found 324.1356.

8-Allyl-2-(4-methoxyphenyl)chroman-4-one (12ab):[44] following the general procedure, **11ab** (294 mg, 1.00 mmol) was converted to **12ab** (194 mg, 0.66 mmol, 66%): yellowish oil. ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.82 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.41 (d, *J* = 8,7 Hz, 2H), 7.38 (dm, *J* = 7.4 Hz, 1H), 6.99 (dd, *J* = 7.6, 7.6 Hz, 1H), 6.96 (d, *J* = 8.9 Hz, 2H), 5.97 (ddt, *J* = 17.2, 10.6, 6.7 Hz, 1H), 5.43 (dd, *J* = 13.3, 2.9 Hz, 1H), 5.09 – 5.05 (m, 2H), 3.84 (s, 3H), 3.42 (d, *J* = 6.7 Hz, 2H), 3.06 (dd, *J* = 16.8, 13.3 Hz, 1H), 2.89 (dd, *J* = 16.8, 2.9 Hz, 1H) ppm; ^{13}C NMR (150 MHz, $CDCl_3$): δ = 192.7, 159.9, 159.5, 136.3, 136.1, 131.2, 129.6, 127.5, 125.2, 121.2, 121.0, 116.3, 114.2, 79.1, 55.5, 44.6. 34.0 ppm; IR (ATR): $\tilde{\nu}$ = 2905 (w), 2836 (w), 1687 (s), 1595 (s), 1514 (s), 1475 (m), 1443 (s), 1300 (s), 1249 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{19}H_{18}O_3$ [M$^+$] 294.1256; found 294.1252.

8-Allyl-2-(4-bromophenyl)chroman-4-one (12ac): following the general procedure, **11ac** (343 mg, 1.00 mmol) was converted to **12ac** (261 mg, 0.76 mmol, 76%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.82 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.57 (d, *J* = 8.5 Hz, 2H), 7.43 – 7.33 (m, 3H), 7.01 (t, *J* = 7.6 Hz, 1H), 5.97 (ddt, *J* = 17.1, 10.6, 6.6 Hz, 1H), 5.45 (dd, *J* = 12.5, 3.5 Hz, 1H), 5.13 – 5.01 (m, 2H), 3.43 (d, *J* = 6.7 Hz, 2H), 3.00 (dd, *J* = 16.8, 12.6 Hz, 1H), 2.90 (dd, *J* = 16.8, 3.6 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 191.9, 159.2, 138.2, 136.5, 136.0, 132.1, 129.6, 127.7, 125.4, 122.7, 121.6, 121.0, 116.4, 78.7, 44.6, 34.0 ppm; IR (ATR): $\tilde{\nu}$ = 3078 (w), 2901 (w), 1689 (s), 1595 (s), 1475 (s), 1445 (s), 1300 (s), 1219 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}{}^{79}BrO_2$ [M$^+$] 342.0255; found 342.0263.

8-Allyl-2-(4-chlorophenyl)chroman-4-one (12ad):[20] following the general procedure, **11ad** (298 mg, 1.00 mmol) was converted to **12ac** (158 mg, 0.53 mmol, 53%): yellowish oil. ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.82 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.43 (d, *J* = 8.7 Hz, 2H), 7.41 (d, *J* = 8.7 Hz, 2H), 7.40 (dm, *J* = 7.5 Hz, 1H), 7.01 (t, *J* = 7.6 Hz, 1H), 5.97 (ddt, *J* = 17.0, 10.2, 6.6 Hz, 1H), 5.46 (dd, *J* = 13.2, 3.1 Hz, 1H), 5.10 – 5.05 (2H), 3.43 (d, *J* = 6.6 Hz, 2H), 3.01 (dd, *J* = 16.8, 13.2 Hz, 1H), 2.91 (dd, *J* = 16.8, 3.1 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 192.0, 159.2, 137.7, 136.5, 136.0, 134.5, 129.5, 129.1, 127.4, 125.3, 121.6, 120.9, 116.4, 78.6, 44.6, 34.0 ppm; IR (ATR): $\tilde{\nu}$ = 3076 (w), 2905 (w), 1688 (s), 1596 (s), 1492 (m), 1475 (s), 1444 (s), 1299 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}{}^{35}ClO_2$ [M$^+$] 298.0761; found 298.0766.

8-Allyl-2-(4-nitrophenyl)chroman-4-one (12ae): following the general procedure, **11ae** (309 mg, 1.00 mmol) was converted to **12ae** (204 mg, 0.66 mmol, 66%): orange-yellow solid, mp = 83 - 86 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.31 (d, *J* = 8.8 Hz, 2H), 7.83 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.68 (d, *J* = 8.4 Hz, 2H), 7.43 (dd, *J* = 7.3, 1.7 Hz, 1H), 7.04 (t, *J* = 7.6 Hz, 1H), 5.98 (ddt, *J* = 17.0, 10.1, 6.6 Hz, 1H), 5.60 (dd, *J* = 11.9, 4.4 Hz, 1H), 5.12 – 5.05 (m, 2H), 3.46 (d, *J* = 6.2 Hz, 2H), 3.00 (dd, *J* = 16.8, 11.9 Hz, 1H), 2.96 (dd, *J* = 16.8, 3.9 Hz, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 191.1, 158.8, 148.0, 146.2, 136.8, 135.8, 129.5, 126.7, 125.4, 124.2, 122.0, 121.0,116.5, 78.2, 44.6, 34.0 ppm; IR (ATR): $\tilde{\nu}$ = 3079 (w), 2913 (w), 1689 (s), 1597 (s), 1518 (s), 1475 (m), 1446 (m), 1344 (s), 1299 (m), 1291(m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{18}H_{15}NO_4$ [M$^+$] 309.1001; found 309.1004.

8-Allyl-7-(methoxymethoxy)-2-(4-methoxyphenyl)chroman-4-one (12bb): following the general procedure, **11bb** (354 mg, 1.00 mmol) was converted to **12bb** (219 mg, 0.62 mmol, 62%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.82 (d, *J* = 8.9 Hz, 1H), 7.40 (d, *J* = 8.7 Hz, 2H), 6.95 (d, *J* = 8.7 Hz, 2H), 6.82 (d, *J* = 8.9 Hz, 1H), 5.92 (ddt, *J* = 16.8, 10.0, 6.3 Hz, 1H), 5.41 (dd, *J* = 12.7, 3.1 Hz, 1H), 5.26 (s, 2H), 5.05 – 4.92 (2H), 3.83 (s, 3H), 3.47 (s, 3H), 3.44 (d, *J* = 6.3 Hz, 2H), 3.01 (dd, *J* = 16.8, 12.7 Hz, 1H), 2.85 (dd, *J* = 16.8, 3.2 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 191.6, 161.0, 160.7, 159.9, 136.0, 131.4, 127.5, 126.6, 117.0, 116.0, 114.9, 114.2, 107.8, 94.2, 79.3, 56.5, 55.5, 44.3, 27.5 ppm; IR (ATR): $\tilde{\nu}$ = 2907 (w), 2835 (w), 1681 (s), 1595 (s), 1514 (s), 1438 (m), 1334 (m), 1252 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{21}H_{22}O_5$ [M$^+$] 354.1467; found 354.1473.

8-Allyl-2-(4-bromophenyl)-7-(methoxymethoxy)chroman-4-one (12bc): following the general procedure, **11bc** (403 mg, 1.00 mmol) was converted to **12bc** (193 mg, 0.48 mmol, 48%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.82 (d, *J* = 8.9 Hz, 1H), 7.56 (d, *J* = 8.5 Hz, 2H), 7.35 (d, *J* = 8.3 Hz, 2H), 6.84 (d, *J* = 8.9 Hz, 1H), 5.92 (ddt, *J* = 17.0, 10.1, 6.2 Hz, 1H), 5.42 (dd, *J* = 12.1, 3.8 Hz, 1H), 5.26 (s, 2H), 5.04 – 4.92 (m, 2H), 3.47 (s, 3H), 3.45 (dm, *J* = 6.4 Hz, 2H), 2.95 (dd, *J* = 16.8, 12.1 Hz, 1H), 2.85 (dd, *J* = 16.8, 3.8 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 190.9, 161.1, 160.3, 138.4, 135.8, 132.0, 127.7, 126.7, 122.5, 117.0, 115.9, 115.0, 108.1, 94.1, 78.9, 56.5, 44.4, 27.5 ppm; IR (ATR) $\tilde{\nu}$ = 2905 (w), 1682 (m), 1594 (s), 1488 (m), 1437 (m), 1256 (m), 1199 (m), 1154 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{79}BrO_4$ [M$^+$] 402.0467; found 402.0461.

8-Allyl-2-(4-Chlorophenyl)-7-(methoxymethoxy)chroman-4-one (12bd):[45] following the general procedure, **11bd** (358 mg, 1.00 mmol) was converted to **12bd** (179 mg, 0.50 mmol, 50%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.82 (d, *J* = 8.9 Hz, 1H), 7.44 – 7.38 (m, 4H), 6.84 (d, *J* = 8.9 Hz, 1H), 5.92 (ddt, *J* = 17.0, 10.1, 6.2 Hz, 1H), 5.44 (dd, *J* = 12.2, 3.8 Hz, 1H), 5.26 (s, 2H), 5.04 – 4.93 (m, 2H), 3.47 (s, 3H), 3.45 (dm, *J* = 6.1 Hz, 2H), 2.96 (dd, *J* = 16.8, 12.2 Hz, 1H), 2.86 (dd, *J* = 16.8, 3.8 Hz, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$): δ = 190.9, 161.1, 160.3, 137.8, 135.8, 134.4, 129.1, 127.4, 126.7, 117.0, 115.9, 115.0, 108.1, 94.1, 78.8, 56.5, 44.4, 27.5 ppm; IR (ATR): $\tilde{\nu}$ = 2906 (w), 1682 (s), 1595 (s), 1492 (m), 1437 (m), 1256 (m), 1199 (m), 1154 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{35}ClO_4$ [M$^+$] 358.0972; found 358.0970.

8-Allyl-7-(methoxymethoxy)-2-(4-(methoxymethoxy)phenyl)-chroman-4-one (12bf):[45] following the general procedure, **11bf** (384 mg, 1.00 mmol) was converted to **12bf** (230 mg, 0.60 mmol, 60%): yellowish oil. ^{1}H NMR (400 MHz, [D_6]acetone): δ = 7.74 (d, *J* = 8.8 Hz, 1H), 7.52 (d, *J* = 8.9 Hz, 2H), 7.11 (d, *J* = 8.9 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 1H), 5.93 (ddt, *J* = 17.0, 10.1, 6.3 Hz, 1H), 5.55 (dd, *J* = 12.7, 3.2 Hz, 1H), 5.33 (s, 2H), 5.23 (s, 2H), 4.99 (dq, *J* = 17.0, 1.8 Hz, 1H), 4.92 (dq, *J* = 10.1, 1.8 Hz, 1H), 3.45 (s, 3H), 3.45 (s, 3H), 3.43 (dm, *J* = 6.4 Hz, 2H), 3.05 (dd, *J* = 16.8, 12.7 Hz, 1H), 2.85 – 2.77 (m, 3H) ppm; ^{13}C NMR (100 MHz, [D_6]acetone): δ = 191.1, 161.5, 161.2, 158.4, 136.8, 133.7, 128.5, 126.7, 117.4, 117.1, 116.7, 115.2, 108.5, 95.1, 94.9, 80.1, 56.5, 56.1, 44.6, 28.0 ppm; IR (ATR): $\tilde{\nu}$ = 2902 (w), 2827 (w), 1682 (m), 1596 (s), 1511 (m), 1438 (m), 1233 (s), 1150 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{22}H_{24}O_6$ [M$^+$] 384.1573; found 384.1569.

8-Allyl-5,7-bis(methoxymethoxy)-2-(3,4-bis(methoxymethoxy)-phenyl)-chroman-4-one (12ce) and (*E*)-1-(3-allyl-2-hydroxy-4,6-bis(methoxymethoxy))-3-(3,4-bis(methoxy-methoxy)-phenyl)-prop-2-ene-1-one (13ce): following the general procedure, **11ce** (252 mg, 0.50 mmol) was converted to **12ce** (107 mg, 0.21 mmol, 42%) and **13ce** (62 mg, 0.12 mmol, 25%). The products were separated by column chromatography on silica, using hexanes-MTBE mixtures of increasing polarity as eluents. *Analytical data of **12ce***: yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.30 (d, *J* = 2.1 Hz, 1H), 7.19 (d, *J* = 8.4 Hz, 1H), 7.04 (dd, *J* = 8.5, 2.1 Hz, 1H), 6.58 (s, 1H), 5.93 (ddt, *J* = 16.4, 10.0, 6.2 Hz, 1H), 5.35 (dd, *J* = 12.8, 3.2 Hz, 1H), 5.27 (s, 2H), 5.25 (s, 2H), 5.25 (s, 2H), 5.24 (s, 2H), 5.07 – 4.90 (m, 2H), 3.56 – 3.50 (m, 9H), 3.47 (s, 3H), 3.38 (d, *J* = 6.0 Hz, 2H), 2.96 (dd, *J* = 16.5, 12.9 Hz, 1H), 2.81 (dd, *J* = 16.5, 3.3 Hz, 1H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 189.9, 161.2, 160.7, 158.0, 147.5, 147.3, 136.3, 133.6, 119.9, 116.7, 114.7, 114.6, 110.8, 107.6, 96.0, 95.6, 95.5, 95.5, 94.2, 78.3, 56.6, 56.5, 56.3, 56.3, 45.9, 27.3 ppm; IR (ATR): $\tilde{\nu}$ = 3344 (br), 2930 (m), 1606 (s), 1509 (m), 1437 (m), 1261 (m), 1151 (s), 1061 (s), 988 (s), 920 (s), 818 (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{26}H_{32}O_{10}$ [M$^+$] 504.1995; found 504.1991. *Analytical data of **13ce***: yellowish solid, mp 111 – 113 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ = 13.94 (s, 1H), 7.85 (d, *J* = 15.6 Hz, 1H), 7.73 (d, *J* = 15.5 Hz, 1H), 7.50 (d, *J* = 1.8 Hz, 1H), 7.21 (dd, *J* = 8.4, 1.9 Hz, 1H), 7.17 (d, *J* = 8.4 Hz, 1H), 6.42 (s, 1H), 5.96 (ddt, *J* = 16.2, 10.0, 6.0 Hz, 1H), 5.29 (s, 2H), 5.28 (s, 2H), 5.27 (s, 2H), 5.24 (s, 2H), 5.02 (dq, *J* = 17.0, 1.9 Hz, 1H), 4.95 (dq, *J* = 10.0, 1.9 Hz, 1H), 3.53 (s, 3H), 3.53 (s, 3H), 3.52 (s, 3H), 3.47 (s, 3H), 3.39 (dm, *J* = 6.1 Hz, 2H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 193.2, 164.1, 160.9, 158.7, 149.2, 147.6, 142.2, 136.5, 130.1, 126.4, 124.2, 116.3, 115.4, 114.3, 110.2, 107.7, 95.6, 95.4, 95.3, 94.0, 92.2, 56.9, 56.5, 56.5, 56.4, 26.8 ppm; IR (ATR): $\tilde{\nu}$ = 3299 (br), 2921 (m), 1595 (s), 1514 (m), 1445 (m), 1284 (m), 1111 (m), 984 (m), 814 (w), 631 (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{26}H_{32}O_{10}$ [M$^+$] 504.1995; found 504.1986.

General procedure for the synthesis of 8-prenyl-2-arylflavan-4-ones 14: *method 1*: To a solution of the corresponding 8-allyl flavan-4-one **12** (1.00 mmol) in CH_2Cl_2 (5 mL) was added 2-methyl-2-butene (11.60 mL, 110.0 mmol) and second generation Grubbs' catalyst **A** (42 mg, 5.0 mol %). The mixture was stirred at ambient temperature for 16 h, all volatiles were evaporated and the residue was purified by chromatography on silica, using hexanes / MTBE mixtures of increasing polarity as eluents, to furnish the corresponding 8-prenyl-flavan-4-ones **14**. *Method 2*: To a solution of the corresponding 8-allyl flavan-4-one **12** (1.00 mmol) in CH_2Cl_2 (5 mL) was added 2-methyl-2-butene (11.60 mL, 110.0 mmol) and second generation Grubbs' catalyst **A** (42 mg, 5.0 mol %). The mixture was stirred at ambient temperature for 16 h, all volatiles were evaporated and the residue was redissolved in methanol (20 mL). Aq. HCl (3 M, 0.10 mL) was added and the solution was heated to 65 °C for 1 h. After cooling to ambient temperature the mixture was diluted with water (30 mL) and extracted with ethyl acetate (3 times, 30 mL each). The combined organic extracts were dried with MgSO4, filtered and evaporated. The residue was purified by chromatography on silica, using hexanes / MTBE mixtures of increasing polarity as eluents, to furnish the corresponding deprotected 8-prenyl-flavan-4-ones **14**.

8-(3-Methylbut-2-en-1-yl)2-phenylchroman-4-one (14aa):[46] following the general procedure, method 1, **12aa** (264 mg, 1.00 mmol) was

converted to **14aa** (245 mg, 0.84 mmol, 84%): yellowish oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.80 (dm, *J* = 7.9 Hz, 1H), 7.54 – 7.35 (m, 6H), 6.99 (t, *J* = 7.6 Hz, 1H), 5.50 (dd, *J* = 12.9, 3.2 Hz, 1H), 5.30 (t, *J* = 7.4 Hz, 1H), 3.38 (d, *J* = 7.3 Hz, 2H), 3.05 (dd, *J* = 16.8, 12.9 Hz, 1H), 2.95 (dd, *J* = 16.8, 3.2 Hz, 1H), 1.75 (s, 3H), 1.64 (s, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 192.5, 159.5, 139.3, 136.0, 133.4, 131.1, 128.9, 128.7, 126.1, 124.9, 121.8, 121.0, 120.8, 79.4, 44.8, 28.3, 25.9, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 2912 (w) 1689 (s), 1595 (m), 1475 (m), 1440 (m), 1304 (m), 1221 (m), 1071(m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{20}O_2$ [M$^+$] 292.1463; found 292.1467.

7-Hydroxy-8-(3-methylbut-2-en-1-yl)-2-phenylchroman-4-one (14ba):[47] following the general procedure, method 2, **12ba** (324 mg, 1.00 mmol) was converted to **14ba** (225 mg, 0.73 mmol, 73%): yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.76 (d, *J* = 8.7 Hz, 1H), 7.51 – 7.36 (m, 5H), 6.56 (d, *J* = 8.7 Hz, 1H), 6.25 (s(br.), 1H), 5.47 (dd, *J* = 12.9, 3.2 Hz, 1H), 5.26 (t, *J* = 7.2 Hz, 1H), 3.43 (d, *J* = 7.1 Hz, 2H), 3.02 (dd, *J* = 16.8, 12.9 Hz, 1H), 2.87 (dd, *J* = 16.8, 3.3 Hz, 1H), 1.74 – 1.71 (m, 6H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 191.9, 161.9, 161.1, 139.3, 134.7, 128.9, 128.7, 126.6, 126.1, 121.3, 115.1, 114.9, 110.8, 79.7, 44.3, 26.0, 22.4, 18.0 ppm; IR (ATR): $\tilde{\nu}$ = 3224 (br), 2968 (w), 2926 (w), 1657 (m), 1583 (s), 1438 (s), 1368 (m), 1335 (m), 1279 (s), 1218 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{20}O_3$ [M$^+$ 308.1412; found 308.1417.

2-(4-Methoxyphenyl)-8-(3-methylbut-2-en-1-yl)chroman-4-one (14ab): following the general procedure, method 1, **12ab** (294 mg, 1.00 mmol) was converted to **14ab** (306 mg, 0.95 mmol, 95%): yellowish oil. ^{1}H NMR (300 MHz, [D$_6$]acetone): δ = 7.70 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.52 (d, *J* = 8.4 Hz, 2H), 7.42 (dm, *J* = 7.3 Hz, 1H), 7.04 – 6.98 (m, 3H), 5.55 (dd, *J* = 12.9, 3.0 Hz, 1H), 5.29 (tm, *J* = 7.4 Hz, 1H), 3.83 (s, 3H), 3.43 (d, *J* = 7.3 Hz, 2H), 3.13 (dd, *J* = 16.8, 12.9 Hz, 1H), 2.83 (dd, *J* = 16.8, 3.0 Hz, 1H), 1.70 (s, 3H), 1.62 (s, 3H) ppm; ^{13}C NMR (125 MHz, [D$_6$]acetone): δ = 192.3, 160.8, 160.3, 136.3, 133.4, 132.4, 131.7, 128.7, 125.1, 122.8, 121.8, 121.7, 114.7, 79.9, 55.6, 44.7, 28.9, 25.9, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 2965 (w), 1687 (s), 1593 (s), 1514 (s), 1475 (s), 1440 (s), 1303 (s), 1250 (s), 1175 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{21}H_{22}O_3$ [M$^+$] 322.1569; found 322.1559.

2-(4-Bromophenyl)-8-(3-methylbut-2-en-1-yl)chroman-4-on (14ac): following the general procedure, method 1, **12ac** (343 mg, 1.00 mmol) was converted to **14ac** (371 mg, 1.00 mmol, quant.): yellowish oil. ^{1}H NMR (300 MHz, [D$_6$]acetone): δ = 7.70 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.65 (dm, *J* = 8.7 Hz, 2H), 7.57 (dm, *J* = 8.7 Hz, 2H), 7.44 (dm, *J* = 7.4 Hz, 1H), 7.01 (t, *J* = 7.6 Hz, 1H), 5.65 (dd, *J* = 12.9, 3.1 Hz, 1H), 5.30 (tm, *J* = 7.4 Hz, 1H), 3.37 (d, *J* = 7.4 Hz, 2H), 3.10 (dd, *J* = 16.8, 12.9 Hz, 1H), 2.89 (dd, *J* = 16.8, 3.1 Hz, 1H), 1.71 (s, 3H), 1.64 (s, 3H) ppm; ^{13}C NMR (75 MHz, [D$_6$]acetone): δ = 191.7, 159.9, 139.9, 136.4, 133.4, 132.5, 131.7, 129.2, 125.1, 122.7, 122.6, 122.0, 121.8, 79.4, 44.7, 28.9, 25.9, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 2967 (w), 2912 (w), 1689 (s), 1594 (s), 1489 (m), 1475 (s), 1441 (s), 1304 (s), 1219 (s), 1070 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{79}BrO_2$ [M$^+$] 370.0568; found 370.0560.

2-(4-Chlorophenyl)-8-(3-methylbut-2-en-1-yl)chroman-4-on (14ad): following the general procedure, method 1, **12ad** (298 mg, 1.00 mmol) was converted to **14ad** (290 mg, 0.89 mmol, 89%): yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.79 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.46 – 7.36 (m, 5H), 6.99 (dd, *J* = 7.5, 7.5 Hz, 1H), 5.47 (dd, *J* = 12.9, 3.1 Hz, 1H), 5.27 (tm, *J* = 7.4 Hz, 1H), 3.37 (d, *J* = 7.4 Hz, 2H), 3.10 (dd, *J* = 16.8, 12.9 Hz, 1H), 2.89 (dd, *J* = 16.8, 3.1 Hz, 1H), 1.71 (s, 3H), 1.63 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ = 192.1, 159.3, 137.8, 136.2, 134.5, 133.5, 131.1, 129.1, 127.5, 124.9, 121.6, 121.5, 120.9, 78.6, 44.6, 28.3, 25.9, 18.0 ppm; IR (ATR): $\tilde{\nu}$ = 2968 (w), 2913 (w), 1688 (s), 1595 (s), 1492 (m), 1475 (s), 1440 (s), 1304 (s), 1220 (s), 1072 (s) cm^{-1}; HRMS (EI): m/z calcd for $C_{20}H_{19}{}^{35}ClO_2$ [M$^+$] 326.1074; found 326.1073.

8-(3-Methylbut-2-en-1-yl)-2-(4-nitrophenyl)chroman-4-on (14ae): following the general procedure, method 1, **12ae** (309 mg, 1.00 mmol) was converted to **14ae** (307 mg, 0.91 mmol, 91%): yellowish solid, mp 78 – 80 °C. ^{1}H NMR (300 MHz, [D$_6$]acetone): δ = 8.34 (dm, *J* = 8.8 Hz, 2H) 7.93 (dm, J = 8.8 Hz, 2H), 7.72 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.47 (dm, *J* = 7.4 Hz, 1H), 7.04 (t, *J* = 7.6 Hz, 1H), 5.85 (dd, *J* = 12.6, 3.5 Hz, 1H), 5.32 (tm, *J* = 7.4 Hz, 1H), 3.41 (d, *J* = 7.4 Hz, 2H), 3.13 (dd, *J* = 16.8, 12.6 Hz, 1H), 3.00 (dd, *J* = 16.8, 3.5 Hz, 1H), 1.72 (s, 3H), 1.65 (s, 3H) ppm; ^{13}C NMR (75 MHz, [D$_6$]acetone): δ = 191.3, 159.7, 148.8, 147.8, 136.6, 133.6, 131.7, 128.2, 125.2, 124.6, 122.7, 122.2, 121.8, 79.1, 44.7, 28.9, 25.9, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 2970 (w), 2913 (w), 1688 (s), 1595 (s), 1519 (s), 1475 (s), 1442 (s), 1344 (s), 1303 (s), 1220 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}NO_4$ [M$^+$] 337.1314; found 337.1316.

7-Hydroxy-2-(4-methoxyphenyl)-8-(3-methylbut-2-en-1-yl)chroman-4-one (Lespeflorin A$_2$, 4):[50] following the general procedure, method 2, **12bb** (354 mg, 1.00 mmol) was converted to **4** (260 mg, 0.77 mmol, 77%): yellowish solid, mp 85 – 87 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.60 (s, 1H), 7.39 (dm, *J* = 8.8 Hz, 2H), 7.26 (d, *J* = 8.7 Hz, 1H), 6.96 (dm, *J* = 8.8 Hz, 2H), 6.48 (d, *J* = 8.7 Hz, 1H), 5.41 (dd, *J* = 12.9, 3.1 Hz, 1H), 5.23 (tm, *J* = 7.2 Hz, 1H), 3.83 (s, 3H), 3.23 (d, *J* = 7.1 Hz, 2H), 3.12 (dd, *J* = 16.9, 12.9 Hz, 1H), 2.87 (dd, *J* = 16.9, 3.1 Hz, 1H), 1.73 (s, 3H), 1.62 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 198.6, 160.3, 160.0, 158.6, 138.7, 132.9, 130.8, 127.6, 122.2, 120.1, 114.2, 109.0, 108.1, 78.6, 55.5, 43.8, 27.6, 25.9, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 3282 (br), 2982 (w), 1733 (w), 1675 (w), 1588 (m), 1515 (m), 1441 (m), 1373 (m), 1373 (w), 1250 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{21}H_{22}O_4$ [M$^+$] 338.1518; found 338.1522.

2-(4-Bromophenyl)-7-hydroxy-8-(3-methylbut-2-en-1-yl)chroman-4-on (14bc): following the general procedure, method 2, **12bc** (403 mg, 1.00 mmol) was converted to **14bc** (263 mg, 0.68 mmol, 68%): yellowish solid, mp 162 – 164 °C. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.74 (d, *J* = 8.7 Hz, 1H), 7.55 (dm, *J* = 8.5 Hz, 2H), 7.35 (dm, *J* = 8.2 Hz, 2H), 6.82 (s, 1H), 6.58 (d, *J* = 8.7 Hz, 1H), 5.43 (dd, *J* = 12.9, 3.1 Hz, 1H), 5.24 (tm, *J* = 7.2 Hz, 1H), 3.41 (d, *J* = 7.2 Hz, 2H), 2.96 (dd, *J* = 16.9, 12.9 Hz, 1H), 2.84 (dd, *J* = 16.9, 3.2 Hz, 1H), 1.73 (d, *J* = 1.0 Hz, 3H), 1.72 (d, *J* = 1.3 Hz, 3H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 191.4, 161.9, 160.8, 138.2, 134.9, 132.0, 127.8, 126.7, 122.6, 121.2, 115.0, 114.9, 111.0, 79.0, 44.1, 26.0, 22.4, 18.1 ppm; IR (ATR): $\tilde{\nu}$ = 3227 (br), 2925 (w), 1660 (m), 1586 (s), 1489 (m), 1441 (s), 1284 (s), 1095 (m), 1067 (m), 1010 (m), 906 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{79}BrO_3$ [M$^+$] 386.0518; found 386.0527.

2-(4-Chlorophenyl)-7-hydroxy-8-(3-methylbut-2-en-1-yl)chroman-4-on (14bd): following the general procedure, method 2, **12bd** (358 mg, 1.00 mmol) was converted to **14bd** (212 mg, 0.62 mmol, 62%): yellowish solid, mp 128 – 130 °C. ^{1}H NMR (300 MHz, [D$_6$]acetone): δ = 9.30 (s, 1H), 7.63 (dm, *J* = 8.6 Hz, 2H), 7.60 (d, *J* = 8.6 Hz, 1H), 7.49 (d, *J* = 8.6 Hz, 2H), 6.65 (d, *J* = 8.6 Hz, 1H), 5.59 (dd, *J* = 12.9, 3.1 Hz, 1H), 5.24 (tm, *J* = 7.3 Hz, 1H), 3.36 (d, *J* = 7.1 Hz, 2H), 2.99 (dd, *J* = 16.8, 12.6 Hz, 1H), 2.79 (dd, *J* = 16.8, 3.2 Hz, 1H), 1.64 (s, 3H), 1.63 (s, 3H) ppm; ^{13}C NMR (75 MHz, [D$_6$]acetone): δ = 190.3, 162.3, 161.6, 139.8, 134.4, 131.8, 129.5, 128.9, 126.4, 123.1, 116.6, 115.4, 110.7, 79.7, 44.6, 25.9, 22.8, 18.0 ppm; IR (ATR): $\tilde{\nu}$ = 3180 (br), 2924 (w), 1655 (w), 1585 (s), 1492 (m), 1441 (s), 1334 (m), 1278 (s), 1092 (m), 1068 (m), 1044 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{19}{}^{35}ClO_3$ [M$^+$] 342.1023; found 342.1034.

7-Hydroxy-2-(4-hydroxyphenyl)-8-(3-methylbut-2-en-1-yl)chroman-4-one (Isobavachin, 2):[16] following the general procedure, method 2, **12bf** (384 mg, 1.00 mmol) was converted to **2** (201 mg, 0.62 mmol, 62%): yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.65 (s, 1H), 7.35 (d, *J* = 8.5 Hz, 2H), 7.29 (dm, *J* = 8.9 Hz, 1H), 6.90 (dm, *J* = 8.5 Hz, 2H), 6.51 (d, *J* = 8.6 Hz, 1H), 6.08 (s(br.), 1H), 5.41 (dd, *J* = 13.1, 2.9 Hz, 1H), 5.23 (tm, *J* = 7.3 Hz, 1H), 3.24 (d, *J* = 7.3 Hz, 2H), 3.14 (dd, *J* = 17.1, 13.1 Hz, 1H), 2.90 (dd, *J* = 17.1, 3.0 Hz, 1H), 1.74 (s, 3H), 1.63 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 199.0, 160.1, 158.7, 156.3, 138.9, 133.0, 130.7, 127.8, 122.1, 120.3, 115.7, 108.9, 108.1, 78.6, 43.7, 27.6, 25.9, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 3251 (br), 2924 (w), 1689 (w), 1654 (w), 1585 (s), 1516 (m), 1438 (s), 1334 (m), 1246 (s), 1168 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{20}H_{20}O_4$ [M$^+$] 324.1362; found 324.1354.

8-Prenyl-5,7-bis(methoxymethoxy)-2-(3,4-bis(methoxymethoxy)-phenyl)-chroman-4-one (14ce): following the general procedure, method 1, **12ce** (200 mg, 0.40 mmol) was converted to **14ce** (160 mg, 0.30 mmol,

76%): yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.28 (d, *J* = 2.1 Hz, 1H), 7.17 (d, *J* = 8.4 Hz, 1H), 7.04 (dd, *J* = 8.4, 2.2 Hz, 1H), 6.56 (s, 1H), 5.33 (dd, *J* = 13.0, 2.9 Hz, 1H), 5.26 – 5.23 (m, 6H), 5.23 (s, 2H), 5.18 (t, *J* = 7.3 Hz, 1H), 3.54 – 3.49 (m, 9H), 3.46 (s, 3H), 3.36 – 3.26 (m, 2H), 2.97 (dd, *J* = 16.5, 13.0 Hz, 1H), 2.79 (dd, *J* = 16.5, 3.0 Hz, 1H), 1.68 – 1.61 (m, 6H) ppm; ^{13}C NMR (101 MHz, $CDCl_3$): δ = 189.9, 161.1, 160.6, 157.7, 147.6, 147.4, 133.6, 131.5, 122.4, 120.2, 116.6, 114.9, 112.6, 107.7, 96.2, 95.7, 95.6, 95.5, 94.2, 78.5, 56.6, 56.4, 56.3, 56.3, 45.9, 25.9, 22.3, 17.8 ppm; IR (ATR): $\tilde{\nu}$ = 2928 (m), 1679 (m), 1594 (s), 1511 (m), 1261 (m), 1151 (s), 1066 (s), 984 (s), 920 (s), 811 (w), 730 (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{28}H_{36}O_{10}$ [M$^+$] 532.2308; found 532.2319.

8-Prenyleriodictyol (6):[67, 69] to a solution of **14ce** (53 mg, 0.100 mmol) in methanol (2.0 mL) was added aq. HCl (3 M, 40 μL). The mixture was heated at 65 °C for 2 h, cooled to ambient temperature and diluted with water (10 mL). The mixture was extraced with ethyl acetate (3 times, 10 mL each), and the combined organic extracts were dried with MgSO4, filtered and evaporated. The residue was purified by column chromatography on silica, using hexanes – ethyl acetate mixture (9 : 1 (v/v)) as eluent, to furnish **6** (15 mg, 0.042 mmol, 42%): colourless solid, mp 197 °C. ^{1}H NMR (400MHz, [D$_4$]methanol): δ = 6.94 (d, *J* = 1.7 Hz, 1H), 6.81 (dd, *J* = 8.3, 1.7 Hz, 1H), 6.78 (d, *J* = 8.4 Hz, 1H), 5.92 (s, 1H), 5.25 (dd, *J* = 12.7, 3.1 Hz, 1H), 5.14 (tm, *J* = 7.3 Hz, 1H), 3.24 – 3.13 (m, 2H), 3.03 (dd, *J* = 17.1, 12.7 Hz, 1H), 2.70 (dd, *J* = 17.1, 3.1 Hz, 1H), 1.62 (s, 3H), 1.58 (s, 3H) ppm; ^{13}C NMR (101MHz, [D$_4$]methanol): δ = 198.0, 166.4, 163.1, 161.5, 146.8, 146.5, 132.1, 131.6, 123.9, 119.7, 116.2, 114.7, 109.1, 103.3, 96.4, 80.3, 44.1, 26.0, 22.5, 17.9 ppm; IR (ATR): $\tilde{\nu}$ = 3312 (br), 2968 (m), 2920 (m), 1633 (s), 1601 (s), 1519 (m), 1439 (m), 1381 (m), 1347 (m), 1269 (m), 1178 (m), 1075 (m), 818 (w), 780 (w) cm^{-1}; HRMS (ESI): *m*/*z* calcd for $C_{20}H_{21}O_6$ [M+H]$^+$ 357.1338; found 357.1337.

Synthetic procedures and analytical data for maximaflavanone A (7) and 6,7,2,2-dimethylchromono-8-prenylflavan-4-one (8)

1-(2-(Allyloxy)-4-((2-methylbut-3-yn-2-yl)oxy)phenyl)ethan-1-one (16): To a solution of **15** (1.09 g, 5.0 mmol) in acetone (25 mL) were added K_2CO_3 (1.40 g, 10.0 mmol) and allyl bromide (0.65 mL, 7.5 mmol). The mixture was heated to 50 °C for 16 h, cooled to ambient temperature, and diluted by addition of brine (10 mL) and water (10 mL). The mixture was extracted with ethyl acetate (3 times, 20 mL each), the combined organic extracts were dried with MgSO4, filtered and evaporated. The residue was purified by chromatography on silica using hexanes / MTBE mixtures of increasing polarity as eluent to furnish compound **16** (1.15 g, 4.5 mmol, 89%): pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.77 (d, *J* = 8.7 Hz, 1H), 6.87 (dd, *J* = 8.7, 2.2 Hz, 1H), 6.79 (d, *J* = 2.2 Hz, 1H), 6.08 (ddt, *J* = 17.4, 10.6, 5.3 Hz, 1H), 5.44 (dm, *J* = 17.3 Hz, 1H), 5.32 (dm, *J* = 10.5 Hz, 1H), 4.61 (d, *J* = 5.3 Hz, 2H), 2.64 (s, 1H), 2.60 (s, 3H), 1.69 (s, 6H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 198.2, 160.8, 159.5, 132.7, 131.8, 122.5, 118.4, 111.9, 104.4, 85.5, 74.7, 72.5, 69.6, 32.2, 29.7 ppm; IR (ATR): $\tilde{\nu}$ = 1665 (m), 1595 (s), 1257 (s), 1181 (m), 1132 (s) (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{16}H_{18}O_3$ [M$^+$] 258.1256; found 258.1254.

(*E*)-1-(2-(Allyloxy)-4-((2-methylbut-3-yn-2-yl)oxy)phenyl)-3-phenyl-prop-2-en-1-one (17): following the general procedure for the synthesis of chalcones **11**, compound **16** (904 mg, 3.50 mmol) and benzaldehyde (0.70 mL, 7.0 mmol) were converted to **17** (1100 mg, 3.20 mmol, 90%): pale yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$): δ = 7.73 (d, *J* = 8.6 Hz, 2H), 7.70 (d, *J* = 15.8 Hz, 1H), 7.64 – 7.54 (m, 3H), 7.45 – 7.33 (m, 3H), 6.94 (dd, *J* = 8.6, 2.2 Hz, 1H), 6.84 (d, *J* = 2.2 Hz, 1H), 6.06 (ddt, *J* = 17.3, 10.4, 5.1 Hz, 1H), 5.45 (dm, *J* = 17.2 Hz, 1H), 5.27 (dm, *J* = 10.5 Hz, 1H), 4.62 (d, *J* = 5.1 Hz, 2H), 2.66 (s, 1H), 1.71 (s, 6H) ppm; ^{13}C NMR (75 MHz, $CDCl_3$): δ = 190.9, 160.5, 158.9, 142.0, 135.5, 132.6, 132.1, 130.1, 128.9, 128.4, 127.4, 123.6, 118.1, 112.3, 104.8, 85.6, 74.7, 72.5, 69.5, 29.7 ppm; IR (ATR): $\tilde{\nu}$ = 2924 (m), 1713 (m), 1655 (m), 1603 (s), 1123 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{23}H_{22}O_3$ [M$^+$] 346.1569; found 346.1550.

10-Allyl-2,2-dimethyl-8-phenyl-7,8-dihydro-2*H*,6*H*-pyrano[3,2-g]-chromen-6-one (18) and 6-allyl-8,8-dimethyl-2-phenyl-2,3-dihydro-4*H*,8*H*-pyrano[2,3-f]chromen-4-one (19): following the general procedure for the microwave promoted synthesis of 8-allylflavanones **12**, compound **17** (346 mg, 1.00 mmol) was converted to a 1 : 1 mixture of the linear product **18** and the angular product **19**. Separation of the products was achieved by column chromatography on silica, using hexanes / MTBE mixtures of increasing polarity, to furnish **18** (65 mg, 0.19 mmol, 19%) and **19** (78 mg, 0.23 mmol, 22%). *Analytical data of **18***: yellowish oil. ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.50 (s, 1H, H5), 7.47 (dm, *J* = 7.1 Hz, 2H, *o*-H(Ph)), 7.43 (tm, *J* = 7.3 Hz, *m*-H(Ph)), 7.37 (tt, *J* = 7.2, 1.4 Hz, 1H, *p*-H(Ph)), 6.33 (d, *J* = 9.9 Hz, 1H, H4), 5.92 (ddt, *J* = 16.5, 10.0, 6.5 Hz, 1H, C*H*=CH$_2$), 5.61 (d, *J* = 9.9 Hz, 1H, H3), 5.46 (dd, *J* = 13.0, 3.1 Hz, 1H, H8), 5.04 (dq, *J* = 17.0, 1.4 Hz, 1H, =CHH^{trans}), 4.97 (dq, *J* = 10.1, 1.5 Hz, 1H, =CHH^{cis}), 3.42 (ddt, *J* = 14.3, 6.4, 1.5 Hz, -CH*H*CH=), 3.38 (ddt, *J* = 14.3, 6.4, 1.5 Hz, -CH*H*CH=), 2.98 (dd, *J* = 16.9, 13.1 Hz, 1H, H7^{trans}), 2.86 (dd, *J* = 16.9, 3.0 Hz, 1H, H7^{cis}), 1.46 (s, 3H, C2(CH$_3$)), 1.44 (s, 3H, C2(CH$_3$)) ppm; ^{13}C NMR (150 MHz, $CDCl_3$): δ = 191.2 (C6), 160.9 (C9a), 157.8 (C4a), 139.4 (*ipso*-C, Ph), 136.0 (*C*H=CH$_2$), 129.5 (C3), 128.8 (*m*-C, Ph), 128.5 (*p*-C, Ph), 126.0 (*o*-C, Ph), 122.7 (C5), 121.8 (C4), 115.9 (C10a), 115.5 (C10), 115.0 (=*C*H$_2$), 114.7 (C5a), 79.5 (C8), 77.9 (C2), 44.5 (C7), 28.7 (C2(*C*H$_3$)), 28.6 (C2(*C*H$_3$)), 27.2 (*C*H$_2$CH=) ppm; IR (ATR): $\tilde{\nu}$ = 2956 (s), 2919 (s), 2870 (w), 2851 (m), 1739 (m), 1691 (m), 1639 (m), 1591 (m), 1463 (m) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{23}H_{22}O_3$ [M$^+$] 346.1569; found 346.1562. *Analytical data of **19***: yellowish oil. ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.63 (s, 1H, H5), 7.48 (d, *J* = 7.4 Hz, 2H, *o*-H(Ph)), 7.43 (tm, *J* = 7.4 Hz, 2H, *m*-H(Ph)), 7.38 (tm, *J* = 7.3 Hz, 1H, *p*-H(Ph)), 6.67 (d, *J* = 9.8 Hz, 1H, H10), 5.96 (ddt, *J* = 16.6, 9.9, 6.7 Hz, 1H, C*H*=CH$_2$), 5.58 (d, *J* = 10.3 Hz, 1H, H9), 5.46 (dd, *J* = 13.5, 2.8 Hz, 1H, H2), 5.09 (dm, *J* = 16.7 Hz, 1H, =CH*H*^{trans}), 5.05 (dm, *J* = 9.9 Hz, 1H, =CH*H*^{cis}), 3.30 (d, *J* = 6.8 Hz, 2H, -C*H*$_2$CH=), 3.00 (dd, *J* = 16.6, 13.5 Hz, 1H, H3^{trans}), 2.84 (dd, *J* = 16.6, 3.0 Hz, 1H, H3^{cis}), 1.47 (s, 3H, C8(CH$_3$)), 1.45 (s, 3H, C8(CH$_3$)); ^{13}C NMR (150 MHz, $CDCl_3$): δ = 190.8 (C4), 157.5 (C6a), 156.5 (C1a), 139.2 (*ipso*-C, Ph), 136.5 (*C*H=CH$_2$), 128.9 (*m*-C, Ph), 128.7 (C9), 128.6 (*p*-C, Ph), 127.5 (C5), 126.1 (*o*-C, Ph), 122.5 (C6), 116.3 (C10), 115.9 (=*C*H$_2$), 114.3 (C4a), 109.3 (C10a), 79.8 (C2), 77.6 (C8), 44.5 (C3), 33.6 (*C*H$_2$CH=), 28.5 (C8(*C*H$_3$)), 28.2 (C8(*C*H$_3$)) ppm; IR (ATR): $\tilde{\nu}$ = 2923 (s), 2853 (m), 1682 (s), 1639 (m), 1605 (s), 1467 (m), 1192 (m), 1160 (s) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{23}H_{22}O_3$ [M$^+$] 346.1569; found 346.1560.

6,7,2,2-Dimethylchromono-8-prenylflavan-4-one (8):[53] following the general procedure, method 1, **18** (346 mg, 1.00 mmol) was converted to **8** (288 mg, 0.77 mmol, 77%): yellowish solid, mp 113 – 114 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.50 – 7.46 (m, 2H), 7.43 (dd, *J* = 7.4, 7.4 Hz, 2H), 7.37 (tt, *J* = 7.3, 1.5 Hz, 1H), 6.32 (d, *J* = 9.9 Hz, 1H), 5.60 (d, *J* = 9.9 Hz, 1H), 5.46 (dd, *J* = 13.0, 3.2 Hz, 1H), 5.21 (tm, *J* = 7.4 Hz, 1H), 3.36 (dd, *J* = 13.6, 6.9 Hz, 1H), 3.31 (dd, *J* = 13.6, 7.3 Hz, 1H), 2.99 (dd, *J* = 16.7, 13.0 Hz, 1H), 2.85 (dd, *J* = 16.9, 3.2 Hz, 1H), 1.68 (s, 3H), 1.67 (s, 3H), 1.46 (s, 3H), 1.44 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$): δ = 191.3, 160.9, 157.7, 139.4, 131.7, 129.4, 128.8, 128.6, 126.1, 122.4, 122.0, 121.9, 117.3, 115.9, 114.7, 79.6, 77.8, 44.5, 28.7, 28.6, 26.0, 22.2, 18.0 ppm; IR (ATR): $\tilde{\nu}$ = 2972 (br), 1679 (s), 1603 (s), 1445 (m), 1315 (w), 1156 (s), 1118 (m), 1072 (w), 895 (w), 754 (w), 697 (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{25}H_{26}O_3$ [M$^+$] 374.1882; found 374.1875.

Maximaflavanone A (7):[66] following the general procedure, method 1, **19** (237 mg, 0.68 mmol) was converted to **7** (239 mg, 0.64 mmol, 94%): yellowish oil. ^{1}H NMR (400MHz, $CDCl_3$): δ = 7.61 (s, 1H), 7.51 – 7.34 (m, 5H), 6.66 (d, *J* = 10.0 Hz, 1H), 5.57 (d, *J* = 10.0 Hz, 1H), 5.45 (dd, *J* = 13.2, 3.0 Hz, 1H), 5.26 (tm, *J* = 7.4 Hz, 1H), 3.23 (d, *J* = 7.2 Hz, 2H), 2.99 (dd, *J* = 16.8, 13.1 Hz, 1H), 2.83 (dd, *J* = 16.8, 3.1 Hz, 1H), 1.73 (s, 6H), 1.47 (s, 3H), 1.44 (s, 3H) ppm; ^{13}C NMR (101MHz, $CDCl_3$): δ = 191.0, 157,7, 156.4, 139.3, 132.6, 128.9, 128.7, 128.7, 127.2, 126.2, 126.1, 124.1, 122.3, 116.4, 114.2, 109.3, 79.8, 77.6, 44.6, 28.5, 28.2, 26.0, 18.0 ppm; IR (ATR) $\tilde{\nu}$ = 2973 (br), 1681 (s), 1637 (m), 1592 (s), 1449 (m), 1377 (m), 1274 (m), 1155 (s), 1119 (m), 1067 (m), 899 (w), 754 (w), 727 (w), 697 (w) cm^{-1}; HRMS (EI): *m*/*z* calcd for $C_{25}H_{26}O_3$ [M$^+$] 374.1882; found 374.1888.

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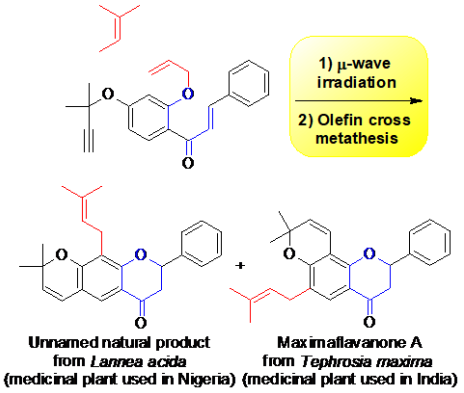
[1] D. Barron, R. K. Ibrahim, *Phytochemistry* **1996**, *43*, 921-982.
[2] T. Nomura, T. Fukai, Y. Hano in *Studies in Natural Products Chemistry, Vol. 28* (Ed.: A.-u. Rahman), Elsevier, **2003**, pp. 199-256.
[3] X. Chen, E. Mukwaya, M.-S. Wong, Y. Zhang, *Pharm. Biol.* **2014**, *52*, 655-660.
[4] O. Lozinski, C. Bennetau-Pelissero, S. Shinkaruk, *ChemistrySelect* **2017**, *2*, 6577-6603.
[5] L. Molčanová, D. Janošíková, S. Dall´Acqua, K. Šmejkal, *Phytochem. Rev.* **2019**, *18*, 1051-1100.
[6] C. M. M. Santos, A. M. S. Silva, *Molecules* **2020**, *25*, 696.
[7] R. Mukai, *Biosci. Biotechnol. Biochem.* **2018**, *82*, 207-215.
[8] X. Yang, Y. Jiang, J. Yang, J. He, J. Sun, F. Chen, M. Zhang, B. Yang, *Trends Food Sci. Tech.* **2015**, *44*, 93-104.
[9] A. Sugiyama, P. J. Linley, K. Sasaki, T. Kumano, H. Yamamoto, N. Shitan, K. Ohara, K. Takanashi, E. Harada, H. Hasegawa, T. Terakawa, T. Kuzuyama, K. Yazaki, *Metab. Eng.* **2011**, *13*, 629-637.
[10] M. Levisson, C. Araya-Cloutier, W. J. C. de Bruijn, M. van der Heide, J. M. Salvador López, J.-M. Daran, J.-P. Vincken, J. Beekwilder, *J. Agric. Food Chem.* **2019**, *67*, 13478-13486.
[11] G. Kretzschmar, O. Zierau, J. Wober, S. Tischer, P. Metz, G. Vollmer, *J. Steroid Biochem. Mol. Biol.* **2010**, *118*, 1-6.
[12] O. Talhi, A. M. S. Silva, *Curr. Org. Chem.* **2013**, *17*, 1067-1102.
[13] A. C. Jain, M. K. Zutshi, *Tetrahedron* **1972**, *28*, 5589-5593.
[14] L. Xiao, W. Tan, Y. Li, *Synth. Commun.* **1998**, *28*, 2861-2869.
[15] Á. Kenéz, S. Antus, *Nat. Prod. Commun.* **2006**, *1*, 51-55.
[16] X. Dong, Y. Fan, L. Yu, Y. Hu, *Arch. Pharm. Chem. Life Sci.* **2007**, *340*, 372-376.
[17] X. Dong, L. Qi, C. Jiang, J. Chen, E. Wei, Y. Hu, *Bioorg. Med. Chem. Lett.* **2009**, *19*, 3196-3198.
[18] C. Huang, Z. Zhang, Y. Li, *J. Nat. Prod.* **1998**, *61*, 1283-1285.
[19] B. Schmidt, M. Riemer, U. Schilde, *Eur. J. Org. Chem.* **2015**, 7602-7611.
[20] B. Schmidt, M. Riemer, U. Schilde, *Synlett* **2014**, *25*, 2943-2946.
[21] S. Nasir Abbas Bukhari, M. Jasamai, I. Jantan, W. Ahmad, *Mini-Rev. Org. Chem.* **2013**, *10*, 73-83.
[22] C. Schultze, B. Schmidt, *J. Org. Chem.* **2018**, *83*, 5210-5224.
[23] K. Hemanth Kumar, P. T. Perumal, *Tetrahedron* **2007**, *63*, 9531-9535.
[24] Z. Du, H. Ng, K. Zhang, H. Zeng, J. Wang, *Org. Biomol. Chem.* **2011**, *9*, 6930-6933.
[25] X. Zheng, H. Jiang, J. Xie, Z. Yin, H. Zhang, *Synth. Commun.* **2013**, *43*, 1023-1029.
[26] K. G. Bedane, R. R. T. Majinda, I. B. Masesane, *Synth. Commun.* **2016**, *46*, 1803-1809.
[27] J. M. Kremsner, A. Stadler, *A Chemist's Guide to Microwave Synthesis*, 2nd ed., Anton Paar GmbH, Graz, **2016**.
[28] D. Dallinger, H. Lehmann, J. D. Moseley, A. Stadler, C. O. Kappe, *Org. Process Res. Dev.* **2011**, *15*, 841-854.
[29] J. M. Kremsner, C. O. Kappe, *J. Org. Chem.* **2006**, *71*, 4651-4658.
[30] L. Perreux, A. Loupy, A. Petit in *Microwaves in Organic Synthesis, Vol. 1* (Eds.: A. De la Hoz, A. Loupy), Wiley-VCH, Weinheim, **2012**, pp. 127-207.
[31] J. Sherwood, M. De bruyn, A. Constantinou, L. Moity, C. R. McElroy, T. J. Farmer, T. Duncan, W. Raverty, A. J. Hunt, J. H. Clark, *Chem. Commun.* **2014**, *50*, 9650-9652.
[32] J. E. Camp, *ChemSusChem* **2018**, *11*, 3048-3055.
[33] T. Brouwer, B. Schuur, *ACS Sustainable Chem. Eng.* **2020**, 10.1021/acssuschemeng.0c04159.
[34] L. Mistry, K. Mapesa, T. W. Bousfield, J. E. Camp, *Green Chem.* **2017**, *19*, 2123-2128.
[35] K. Żukowska, K. Grela in *Comprehensive Organic Synthesis II (Second Edition)*, Elsevier, Amsterdam, **2014**, pp. 1257-1301.
[36] A. K. Chatterjee, D. P. Sanders, R. H. Grubbs, *Org. Lett.* **2002**, *4*, 1939-1942.
[37] A. K. Chatterjee, T.-L. Choi, D. P. Sanders, R. H. Grubbs, *J. Am. Chem. Soc.* **2003**, *125*, 11360-11370.
[38] S. Tischer, P. Metz, *Adv. Synth. Catal.* **2007**, *349*, 147-151.
[39] J. M. Hastings, M. K. Hadden, B. S. J. Blagg, *J. Org. Chem.* **2008**, *73*, 369-373.
[40] P. Pahari, J. Rohr, *J. Org. Chem.* **2009**, *74*, 2750-2754.
[41] J. Magolan, M. J. Coster, *J. Org. Chem.* **2009**, *74*, 5083-5086.
[42] G.-L. Liu, B. Hao, S.-P. Liu, G.-X. Wang, *Eur. J. Med. Chem.* **2012**, *54*, 582-590.
[43] M. Scholl, S. Ding, C. W. Lee, R. H. Grubbs, *Org. Lett.* **1999**, *1*, 953-956.
[44] A. Ceccaldi, A. Rajavelu, C. Champion, C. Rampon, R. Jurkowska, G. Jankevicius, C. Sénamaud-Beaufort, L. Ponger, N. Gagey, H. Dali Ali, J. Tost, S. Vriz, S. Ros, D. Dauzonne, A. Jeltsch, D. Guianvarc'h, P. B. Arimondo, *ChemBioChem* **2011**, *12*, 1337-1345.
[45] X. Dong, T. Liu, J. Yan, P. Wu, J. Chen, Y. Hu, *Bioorg. Med. Chem. Lett.* **2009**, *17*, 716-726.
[46] J. H. Yang, S. Z. Jiang, Y. M. Zhao, Y. F. Li, C. B. Ji, W. Y. Liu, *Chin. Chem. Lett.* **2009**, *20*, 1062-1064.
[47] R. Kumar Gupta, M. Krishnamurti, *Phytochemistry* **1976**, *15*, 832-833.
[48] H. A. Khan, I. Chandrasekharan, A. Ghanim, *Phytochemistry* **1986**, *25*, 767-768.
[49] T. Nikaido, T. Ohmoto, T. Kinoshita, U. Sankawa, F. D. Monache, B. Botta, T. Tomimori, Y. Miyaichi, Y. Shirataki, I. Yokoe, M. Komatsu, *Chem. Pharm. Bull.* **1989**, *37*, 1392-1395.
[50] M. Mori-Hongo, H. Takimoto, T. Katagiri, M. Kimura, Y. Ikeda, T. Miyase, *J. Nat. Prod.* **2009**, *72*, 194-203.
[51] V. K. Bhalla, U. R. Nayak, S. Dev, *Tetrahedron Lett.* **1968**, *9*, 2401-2406.
[52] H. Haraguchi, J. Inoue, Y. Tamura, K. Mizutani, *Phytother. Res.* **2002**, *16*, 539-544.
[53] S. Sultana, M. Ilyas, *Phytochemistry* **1986**, *25*, 963-964.
[54] H. M. H. Muhaisen, *Der Pharma Chem.* **2013**, *5*, 88-96.
[55] H. Yin, S. Zhang, J. Wu, *Z. Naturforsch. B* **2005**, *60*, 356.
[56] H. Yin, S. Zhang, J. Wu, H. Nan, *J. Braz. Chem. Soc.* **2006**, *17*, 1432-1435.
[57] P. M. Dewick, *Medicinal Natural Products*, Wiley, New York, **1997**.
[58] L. Crombie, D. A. Whiting, *Phytochemistry* **1998**, *49*, 1479-1507.
[59] B. Schmidt, C. Schultze, *Eur. J. Org. Chem.* **2018**, 223-227.
[60] J. Garcia, S. Barluenga, K. Beebe, L. Neckers, N. Winssinger, *Chem. Eur. J.* **2010**, *16*, 9767-9771.
[61] M. Harfenist, E. Thom, *J. Org. Chem.* **1972**, *37*, 841-848.
[62] A. Wunderli, T. Winkler, H.-J. Hansen, *Helv. Chim. Acta* **1977**, *60*, 2436-2459.
[63] B. Schmidt, M. Riemer, *Synthesis* **2016**, *48*, 141-149.
[64] E. Venkata Rao, Y. Rajendra Prasad, M. Sree Rama Murthy, *Phytochemistry* **1994**, *37*, 111-112.
[65] R. Wen, H. Lv, Y. Jiang, P. Tu, *Planta Med.* **2018**, *84*, 1174-1182.
[66] R. S. Mali, P. Kulkarni-Joshi, *Indian J. Chem.* **1999**, *38B*, 596-599.
[67] F. Bohlmann, C. Zdero, H. Robinson, R. M. King, *Phytochemistry* **1981**, *20*, 2245-2248.
[68] B. Zhou, C.-X. Wan, *J. Asian Nat. Prod. Res.* **2015**, *17*, 256-261.
[69] R. Chen, X. Liu, J. Zou, Y. Yin, B. Ou, J. Li, R. Wang, D. Xie, P. Zhang, J. Dai, *Adv. Synth. Catal.* **2013**, *355*, 1817-1828.
[70] M. S. Malefo, T. E. Ramadwa, I. M. Famuyide, L. J. McGaw, J. N. Eloff, M. S. Sonopo, M. A. Selepe, *J. Nat. Prod.* **2020**, *83*, 2508-2517.
[71] L. X. Yang, K. X. Huang, H. B. Li, J. X. Gong, F. Wang, Y. B. Feng, Q. F. Tao, Y. H. Wu, X. K. Li, X. M. Wu, S. Zeng, S. Spencer, Y. Zhao, J. Qu, *J. Med. Chem.* **2009**, *52*, 7732-7752.

Key topic: Prenylflavanones

Graphic for Table of Contents:



Text for Table of Contents:

Microwave irradiation of *ortho*-allyloxy chalcones promotes a tandem sequence of Claisen rearrangement and 6-*endo*-trig-cyclization. Olefin cross metathesis then furnishes prenylated flavonoids. The method has, inter alia, been applied to the synthesis of an angular chromene-annellated natural product and its linear isomer. Both occur in medicinal plants indigenous in India and Nigeria respectively.