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Amide Bond Formation Assisted by Vicinal Alkylthio Migration in Enaminones: Metal- and CO-Free Synthesis of α,β-Unsaturated Amides

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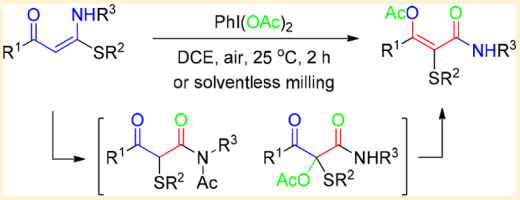
Supporting Information

ABSTRACT: Amide bond formation is one of the most important transformations in organic synthesis, drug development, and materials science. Efficient construction of amides has been among the most challenging tasks for organic chemists. Herein, we report a concise methodology for amide bond (−CONH−) formation assisted by vicinal group migration in alkylthio-functionalized enaminones (α-oxo ketene *N*,*S*-acetals) under mild conditions. Simple treatment of such enaminones with $PhI(OAc)_2$ at ambient temperature in air afforded diverse multiply functionalized α,β-unsaturated amides including β-cyclopropylated acrylamides, in which a wide array of functional groups such as aryl, (hetero)aryl, alkenyl, and alkyl can be conveniently introduced to a ketene moiety. The reaction mechanism was investigated by exploring the origins of the amide oxygen and carbon atoms as well as isolation and structural characterization of the reaction intermediates. The amide bond formation reactions could also be efficiently performed under solventless mechanical milling conditions.



INTRODUCTION

An amide bond is the basic linkage of peptides and proteins and also acts as the key functionality in many pharmaceuticals and functional polymeric materials.[1] Amide bond formation has been among the most challenging organic transformations.[2] However, direct condensation of a carboxylic acid and a primary or secondary amine can not form an amide by loss of water as the byproduct. The conventional method for chemical formation of an amide bond usually involves activation of a carboxylic acid by an activating (coupling) reagent and subsequent coupling of the in situ generated activated form of the carboxylic acid with a free amine through nucleophilic displacement. Without an activator (coupling reagent), the carboxylic acid and amine only form a carboxylate−ammonium salt, instead of an amide, because the reaction thermodynamics are not favorable for amide formation. Although continuous efforts have been devoted to this area,[3] the state of the art conventional method for amide bond formation is approaching its inherent limit.[4]

α,β-Unsaturated amide, that is, acrylamide, is a key structural motif in a variety of natural products and pharmaceutical agents (Scheme 1). For example, (*E*)-*N*-allyl-α,β-dimethylcinnamamide has been pharmaceutically tested as an anticonvulsant agent.[5a] 2-Cyanobut-2-enamide can be used to treat cell proliferative disorders characterized by inappropriate platelet derived growth factor receptor (PDGF-R) activity.[5b] Retinamide VNHM-1−73 exhibits strong in vivo antibreast cancer activity,[5c] and crotamiton is a scabicidal and antipruritic drug.[5d] A cyclopropyl ring is ranked 10th in a top 100 list of the most frequently used rings in the synthesis of small molecule drugs, which can lock and orient a molecule into its bioactive conformation.[6] Thus, cyclopropylated α,β-unsaturated amides have been applied as important pharmaceutical agents. The analogue of leflunomide metabolite is active in the clinical trials for rheumatoid arthritis, a chronic inflammatory disease.[7a] The grenadamide precursor can be efficiently hydrogenated to give grenadamide, which has exhibited modest cannabinoid receptor-binding activity.[7b] The metabolite U-106305 of jawsamycin is an inhibitor of the cholesteryl ester transfer protein (CETP).[7c] Direct synthesis of α,β-unsaturated amides has been strongly desired due to the limitations of the conventional preparation methods[3] (Scheme 2a). Transition-metal-catalyzed procedures have recently been paid considerable attention for this purpose. Palladium-[8] and iron[9]-catalyzed aminocarbonylation of alkynes with amines and CO gave highly chemoselective and regioselective α,β-unsaturated amides (Scheme 2b). Bimetallic Pd/Cu-catalyzed aerobic

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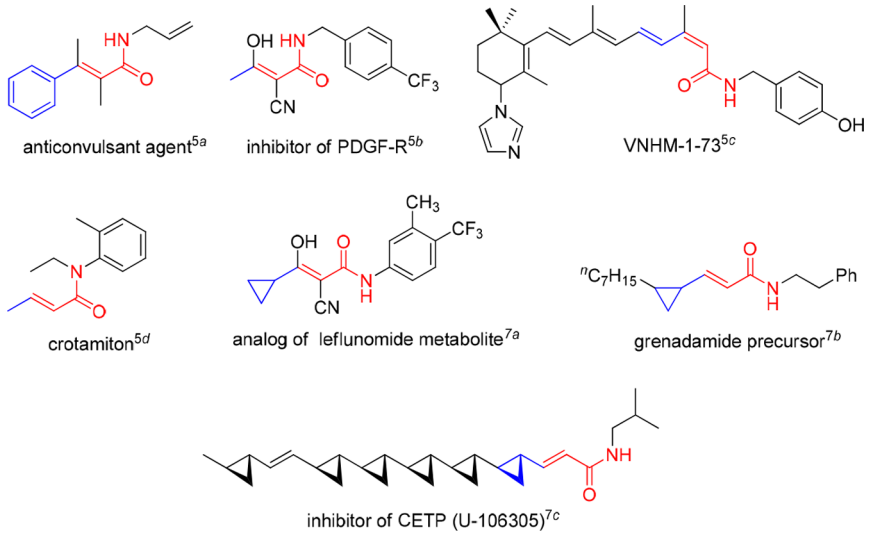
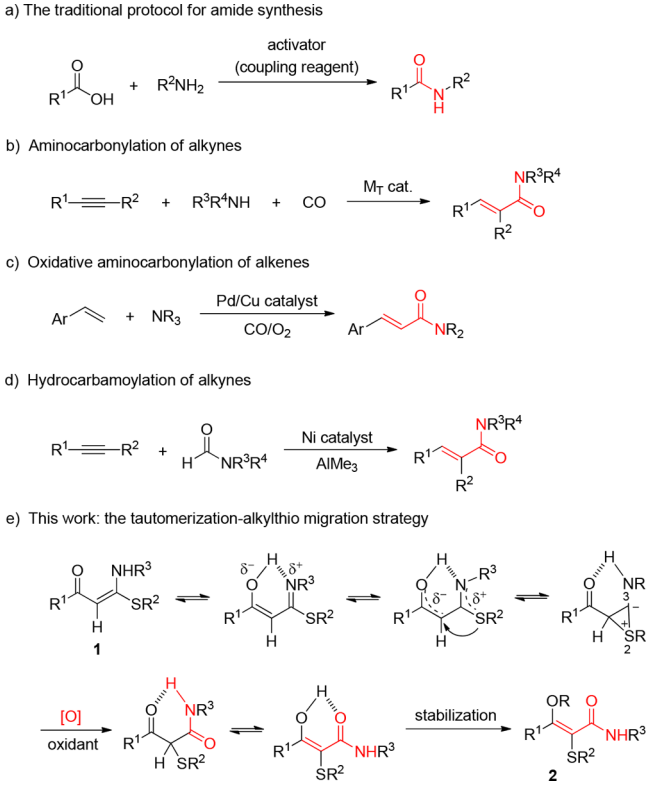
Scheme 1. Selected Pharmaceutical Reagents Containing an α,β-Unsaturated Amide Functionality



Scheme 2. Representative Strategies for the Synthesis of α,β-Unsaturated Amides



oxidative *N*-dealkylative carbonylation of tertiary amines and alkenes produced (*E*)-α,β-unsaturated amides using a CO−O_2 mixed gas[10] (Scheme 2c). Nickel-catalyzed intermolecular hydrocarbamoylation of alkynes with formamides afforded α,β-unsaturated amides[11] (Scheme 2d). However, these methods usually suffer from multistep manipulations, use of transition-metal catalysts and additives, high pressure CO, and/or strong reducing reagents. In the context of drug development, it is always desired to avoid the detrimental effect of transition-metal residues originated from both the transition-metal-catalyzed procedures and use of transition-metal additives, and the strategy to develop a green process usually requires mild reaction conditions and high atom-economy with less wastes.[2] Very recently, Loh and Jiang et al. reported hypervalent iodine(III)-promoted acyloxylation/amidation of stable enamines to generate secondary amine-based amides.[12]

During the continuous investigation of sulfur-functionalized internal alkenes,[13] we envisioned that alkylthio-functionalized enaminones, that is, α-oxo ketene *N*,*S*-acetals,[14] which exist in various tautomers upon the reaction conditions, might undergo oxidative vicinal alkylthio group migration-assisted transformation to form α,β-unsaturated amides (Scheme 2e). The challenge is that enaminones can undergo olefinic C═C bond cleavage to afford α-keto amides in the presence of a transition-metal catalyst under oxidative conditions,[15] and an applicable approach for potential drug development often requires mild and metal-free conditions. Herein, we disclose a concise and efficient protocol for amide bond (−CONH−) formation from alkylthio-functionalized enaminones and hypervalent iodine(III) reagents under mild conditions.

RESULTS AND DISCUSSION

The reaction of enaminone **1a**, that is, (*E*)-3-(benzylamino)-3-(methylthio)-1-phenylprop-2-en-1-one, with phenyliodine(III) diacetate $PhI(OAc)_2$ (PIDA) was conducted to optimize the reaction conditions (Table 1). Enaminone **1a** reacted with PIDA in a 1:1.5 molar ratio in DMF and ethanol at ambient temperature to give the target product α,β-unsaturated amide **2a** in 17−22% yields (Table 1, entries 1 and 2). It is noteworthy that, with 10 mol % $Pd(OAc)_2$ as the catalyst and excess of PIDA as the oxidant, α-acetyl ketene di(ethylthio)-acetal reacted with acetic acid at 50 °C to form the olefinic C−H acetoxylation product in 23% yield.[16] These results have suggested that the functional groups at the termini of the internal olefinic C═C bond of enaminone **1a** are crucial to determine the substrate reactivity and direct the reaction toward formation of the α,β-unsaturated amide product. The solvent effect was remarkable in the cases of using dichloromethane, diethyl ether, 1,4-dioxane, and 1,2-dichloroethane (DCE) as the reaction media, leading to **2a** in 55−75% yields (Table 1, entries 3−6). Varying the amounts of PIDA or elevating the temperature to 40−60 °C diminished the reaction efficiency (Table 1, entries 7−10). It should be noted that

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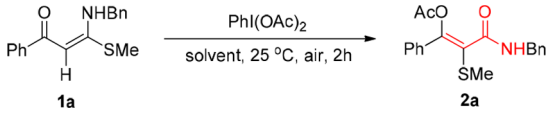
Table 1. Screening of Conditions[a]



1a 2a

entry	$PhI(OAc)_2$ (equiv)	solvent	temp (°C)	yield[b] (%)
1	1.5	DMF	25	17
2	1.5	EtOH	25	22
3	1.5	CH_2Cl_2	25	55
4	1.5	Et_2O	25	63
5	1.5	1,4-dioxane	25	73
6	1.5	DCE	25	75 (72)[c]
7	2.0	DCE	25	71
8	1.0	DCE	25	45
9	1.5	DCE	40	69
10	1.5	DCE	60	44

[a]Conditions: **1a** (0.5 mmol), solvent (5 mL), in air, 2 h. [b]Determined by ^{1}H NMR analysis using 1,3,5-trimethoxyl-benzene as the internal standard. [c]Isolated yield given in parentheses. DCE = 1,2-dichloroethane.

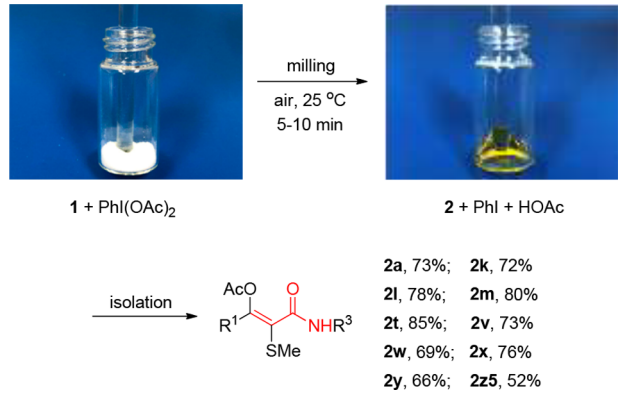
phenyl iodide and acetic acid were detected as the byproducts by GC analysis of the resultant reaction mixture.

The scope of enaminones **1** was then explored (Table 2) under the optimized reaction conditions as shown in entry 6 of Table 1. In the cases of using unsubstituted *α*-benzoyl enaminones **1a–j**, alkyl groups such as benzyl, methyl, ethyl, *n*-butyl, cyclohexyl, 1-phenylethyl, allyl, diphenylmethyl, 2-tetrahydrofuranylmethyl, and 2-furanylmethyl could be tolerated in the amino moiety (NHR^3), and the reactions afforded the target products **2a–j** in 60–90% yields. Substituted benzoyl enaminones **1k–n** also efficiently reacted to produce products **2k–n** (69–86%). 2-Naphthoyl enaminone **1o** did not exhibit an obvious steric effect, forming product **2o** in 80% yield with isolation of *α*-methylthio-*β*-ketoamide **2o′** (5%) as the minor product. However, the electron-withdrawing substituent CF_3 diminished the substrate reactivity to generate the target product **2p** in a relatively low yield (55%), and the minor product *α*-acetoxy-*α*-methylthio-*β*-ketoamide **2p″** was obtained in 18% yield. The formation of compound **2p″** was similar to the production of the *α*-keto amides from copper-catalyzed oxidative C=C activation of enaminones in the presence of a hypervalent iodine(III) reagent.[15] The furoyl and thienoyl enaminones **1q** and **1r** exhibited a lower reactivity than their benzoyl analogues, and their reactions with PIDA afforded **2q** (76%) and **2r** (68%), respectively. Both ethylthio-functionalized enaminones **1s** and **1t** reacted slightly less efficiently than the corresponding methylthio analogues, forming **2s** (80%) and **2t** (84%). Unexpectedly, the reaction of benzylthio enaminone (**1u**) gave the target product **2u** (53%) with formation of *α*-acetoxy-*α*-benzylthio-*β*-ketoamide (**2u″**) in 33% yield. Alkenoyl-based enaminones **1v–x** also reacted well with PIDA to form *β*-vinylated acrylamides **2v–x** (76–82%). Acetyl enaminones **1y–z1** exhibited a reactivity lower than both the aroyl and alkenoyl enaminones, and their reactions with PIDA afforded amides **2y–z1** (63–74%). These results have demonstrated a promising protocol to introduce an aryl, (hetero)aryl, alkenyl, and alkyl group onto a ketene moiety with formation of an amide bond under mild conditions.

Secondary amine-derived enaminones **1z2–z4** reacted with PIDA less efficiently than the primary amine-derived analogues to form **2z2–z4** (71–79%). However, in most of the cases using arylamine-derived enaminones, the reactions formed complicated products, and only in the case of 3,5-dichloroaniline-based enaminone **1z5**, the reaction yielded the target product *β*-vinyl-*α*,*β*-unsaturated amide **2z5** in a moderate yield (53%). It was noted that the enaminone of a dienylamine, that is, geranyl-amine, reacted with PIDA to afford the target amide **2z6** (62%) with the dienyl moiety remaining unchanged. 1,8-Octyl-diamine-derived enaminone **1z7** reacted with 3 equiv of PIDA to form the alkyl chain-bridged diamide **2z7** (71%). Interestingly, the reaction of enaminone **1z8** from *α*-amino acid ester, that is, alanine methyl ester, formed the peptide-type product **2z8** (51%). Chiral enaminones from the corresponding *α*-oxo ketene dithioacetals and chiral amines also efficiently reacted with PIDA, forming chiral *α*,*β*-unsaturated amides **2z9–z12** (73–88%) with a retention of the chirality (99% ee). To our delight, the enaminone of the resolving agent dehydroabietylamine reacted with PIDA to form a complex *α*,*β*-unsaturated amide **2z13** (78%). It is noteworthy that, on a gram scale (5 mmol scale), enaminones **1s** and **1z9** reacted with PIDA to form the corresponding amide products **2s** and **2z9** in 72% (1.06 g) and 87% (1.70 g) yields, respectively, and the molecular structures of compounds **2h**, **2o′**, and **2p″** were further confirmed by the X-ray single crystal structural analysis. (See the Supporting Information for details.)

The amide bond formation reactions of **1** with $PhI(OAc)_2$ could also be efficiently performed under solventless milling conditions. Simple mechanical milling the mixture of enaminone **1** and $PhI(OAc)_2$ with a glass rod at ambient temperature in air for 5–10 min initiated the reaction, affording the target amide product **2** in yields comparative to those obtained in the presence of a solvent (Scheme 3). A decreased

Scheme 3. Amide Bond Formation Reactions Performed under the Solventless Milling Conditions[a]



[a]Conditions: **1** (0.5 mmol), $PhI(OAc)_2$ (0.6 mmol), 25 °C, in air. The reaction mixture was mechanically milled by a glass rod for 5–10 min and then without milling for 1–2 h to complete the reaction.

amount of PIDA (1.2 equiv) was employed in these cases. Such a protocol was realized under the mild conditions and avoided use of a reaction solvent and is thus characteristic of green chemistry,[17] which has demonstrated a potential for its application in synthetic chemistry.

Cyclopropanation has been a challenging reaction in synthetic chemistry. Direct approaches to establish a cyclopropyl motif involves Simmons–Smith cyclopropanation using olefins and diiodomethane in the presence of activated zinc and transition-metal-catalyzed cyclopropanation of alkenes with

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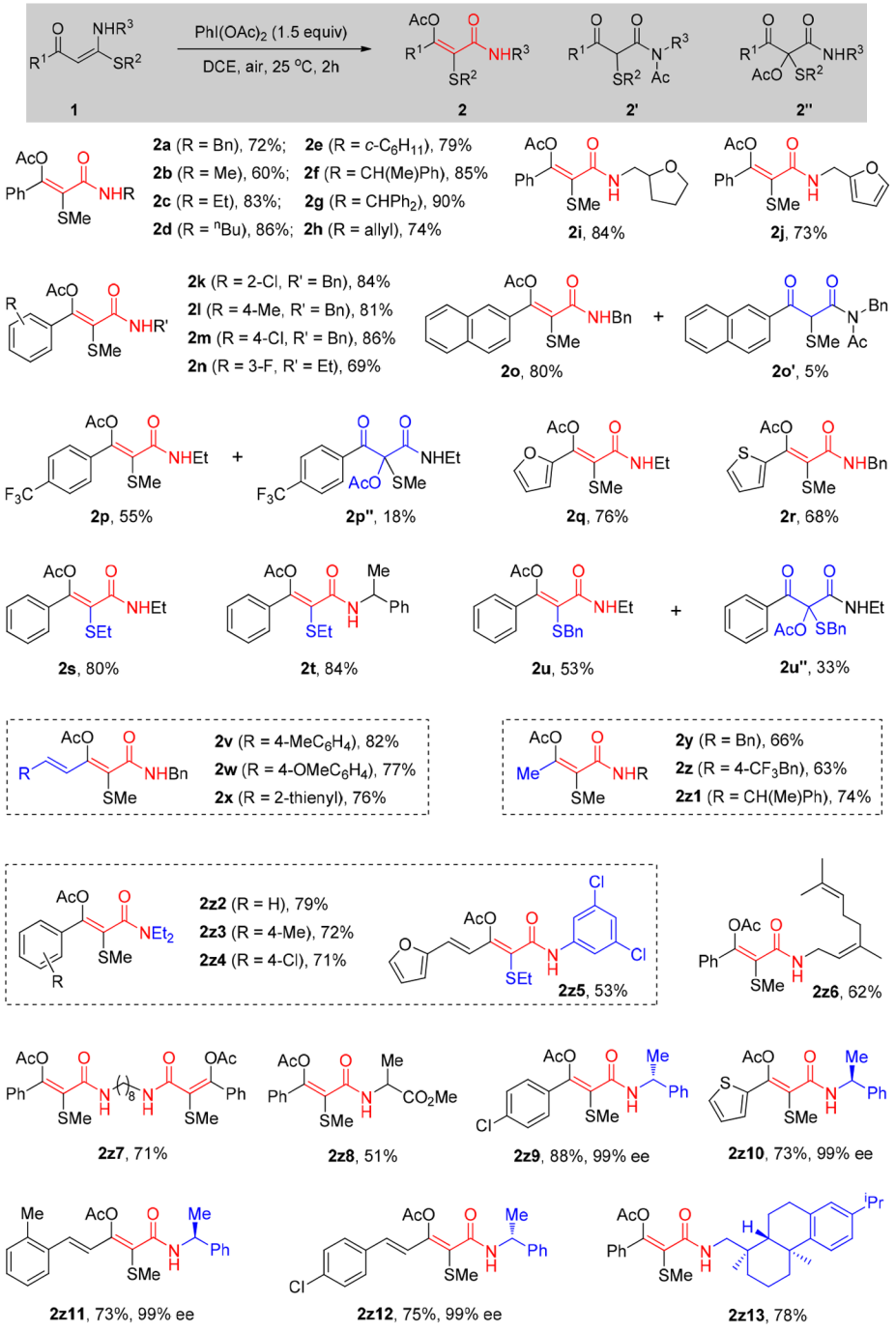
Table 2. Scope of Enaminones 1[a]



[a]Conditions: **1** (0.5 mmol), $PhI(OAc)_2$ (0.75 mmol), DCE (5 mL), in air, 25 °C, 2 h.

diazo compounds and surrogates, which have been well-defined and most widely used.[18] Recently, transition-metal-catalyzed cross-coupling protocols by means of prefunctionalized cyclopropanes[19] and activated cyclopropane derivatives through the C−H activation strategy[20] have been documented for indirect introduction of a cyclopropyl ring into a complex molecular structure. Diverse synthesis of functionalized cyclopropanes under mild conditions is becoming more and more important for the convenient construction of potentially bioactive cyclopropylated acrylamides (Scheme 1).

Next, under the same optimal conditions, enaminones of type **3**, that is, α-cyclopropylcarbonyl ketene *N*,*S*-acetals, were treated with PIDA to form the target β-cyclopropyl-α,β-unsaturated amides (β-cyclopropylated acrylamides) **4** (Table 3). Thus, unsubstituted β-cyclopropylated acrylamide **4a** was obtained in 75% yield. The substituent on the aryl group in the benzylamino moiety (NHBn) exhibited an obvious impact on the yields of **4b**−**i** (70−80%), and electron-donating 2-methyl and 2-methoxy groups favored the formation of both products **4b** and **4e** (80%). Other aliphatic acyclic or cyclic primary amine-derived cyclopropylated enaminones (**3j**−**o**) also efficiently reacted with PIDA to give the target products **4j**−**o** in good to excellent yields (79−88%) with a tolerance of 2-phenylethyl, allyl, isopropyl, cyclopropyl, cyclohexyl, and

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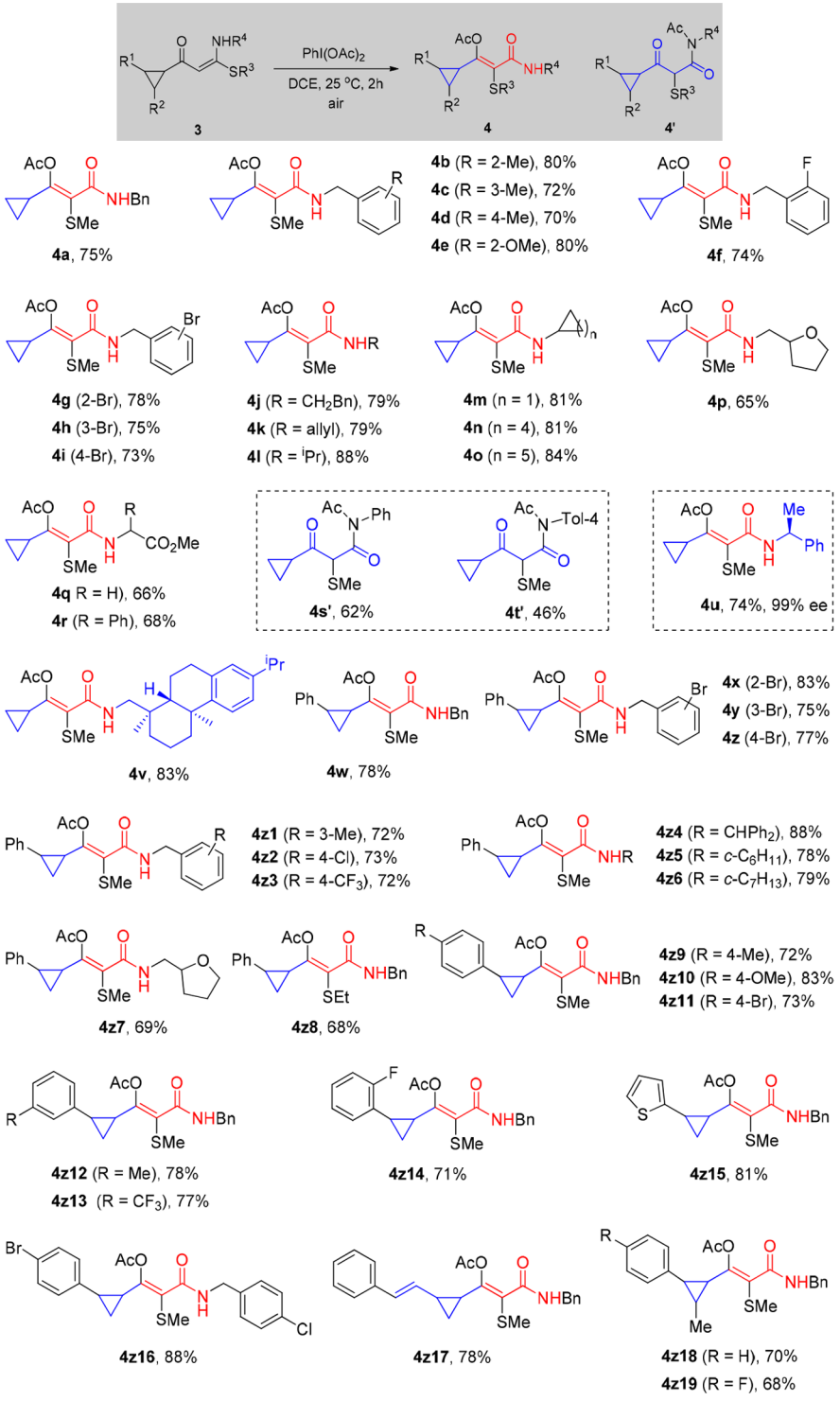
Table 3. Scope of Cyclopropylated Enaminones 3[a]



[a]Conditions: **1** (0.5 mmol), $PhI(OAc)_2$ (0.75 mmol), DCE (5 mL), in air, 25 °C, 2 h.

cycloheptyl in the NHR^3 moiety. However, enaminones **3p**–**r** derived from tetrahydrofuranylmethylamine and methyl α-aminoacetates reacted less efficiently with PIDA to form **4p**–**r** in 65–68% yields. Unexpectedly, the reactions of aniline-derived enaminones **3s** and **3t** with PIDA only formed α-methylthio-β-ketoamides of type **2′**, that is, **4s′** (62%) and **4t′** (46%), respectively. These results may be attributed to the extra stabilization of the aryl group in the NHAr moiety to the reaction intermediate of type **2′** leading to the β-cyclopropylated acrylamide product, which thus prevented the reaction from proceeding to generate the target α,β-unsaturated amide product. In a similar fashion, chiral enaminone **3u** efficiently reacted with PIDA to give chiral β-cyclopropyl-α,β-unsaturated amide **4u** (74%) with 99% ee. The enaminone of dehydroabietylamine (**3v**) reacted to produce the corresponding complex amide **4v** (83%). It should be noted that the molecular structures of compounds **4f** and **4s′** were further

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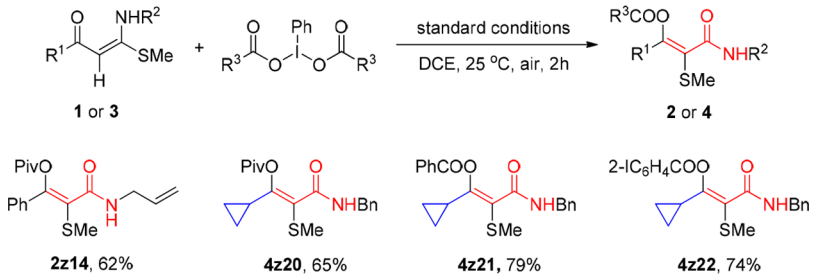
Scheme 4. Exploration of the Hypervalent Iodine Reagents[a]

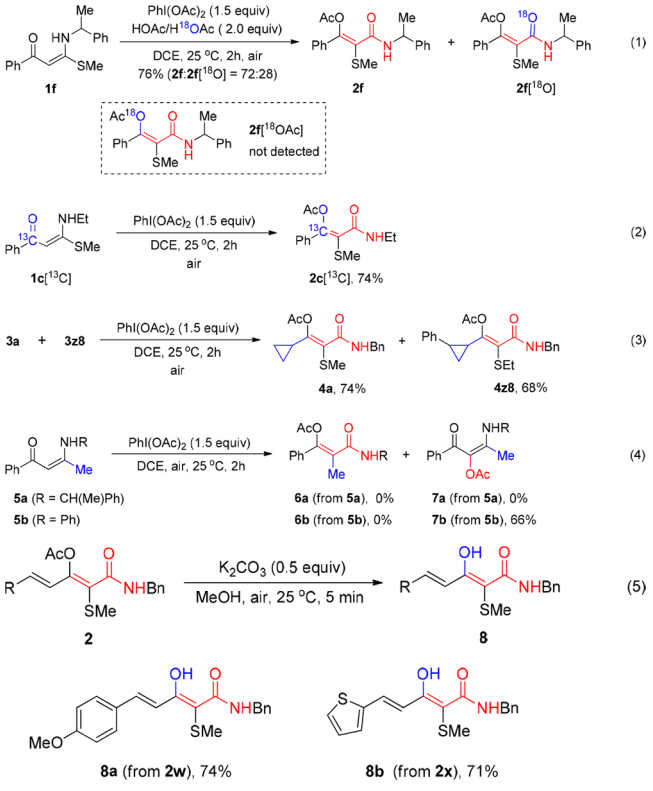


[a]Piv = Pivaloyl.

confirmed by the X-ray single crystal structural determinations. (See the Supporting Information for details.)

Substituted cyclopropylated enaminones **3w**–**z19** reacted well with PIDA to form the target *β*-cyclopropyl-*α*,*β*-unsaturated amides **4w**–**z19** in 68–88% yields. In most of the cases, the substrates exhibited a reactivity similar to that of the unsubstituted *β*-cyclopropylatedenaminones. Aryl, (hetero)aryl, alkenyl, and alkyl were tolerated as the substituent(s) on the cyclopropyl ring, which did not exhibit an obvious impact on the substrate reactivity. Increasing the steric hindrance on the cyclopropyl ring by introducing both an aryl and a methyl only slightly reduced the reaction efficiency to give **4z18** (70%) and **4z19** (68%). It is noteworthy that, on a gram scale (5 mmol scale) of enaminones **3a** and **3w**, the target products **4a** and **4w** were prepared in 72% and 75% yields, respectively. Other PIDA-type hypervalent iodine(III) reagents were also applied as the oxidative amidation/acetoxylation reagents, leading to the target amide products **2z14** and **4z20**–**z22** in 62–79% yields (Scheme 4). Because a wide range of carboxylic acids are available for the preparation of iodine(III) reagents $ArI(OCOR)_2$,[21] diverse ester groups can be conveniently introduced onto the ketene moiety of an *α*,*β*-unsaturated amide.

To gain insights into the reaction mechanism, control experiments were conducted. Reacting enaminone **1f** with PIDA in the presence of a mixture HOAc/H^{18}OAc generated in situ from $H_2{}^{18}O$ and Ac_2O afforded both the target amide **2f** and ^{18}O-labeled amide **2f**[^{18}O] in 76% yield with a molar ratio of **2f**/**2f**[^{18}O] = 72:28 (eq 1). The ^{18}O incorporation was identified in the amide carbonyl by the HRMS analysis of the mixed products, whereas ^{18}O-labeled amide **2f**[^{18}OAc] with ^{18}O incorporation in the acetoxyl group was not detected. (See the Supporting Information.) The exchange between PhI(OAc)$_2$ and H^{18}OAc formed ^{18}O-labeled PhI(^{18}OAc)(OAc) and PhI(^{18}OAc)$_2$,[16] which then reacted with enaminone **1f** to give a mixture of **2f** and **2f**[^{18}O], suggesting that the amide oxygen in **2** and **4** was originated from PIDA, while the acetoxyl oxygen was from the original carbonyl group of **1** and **3**. The ^{13}C-labeled substrate **1c**[^{13}C] reacted with PIDA to form the corresponding ^{13}C-labeled amide product **2c**[^{13}C], which was unambiguously identified by the $^{13}C\{^1H\}$ NMR analysis, revealing that carbonyl migration to form the amide bond did not occur during the reaction (eq 2). In the presence of radical scavengers such as TEMPO (2,2,6,6-tetramethyl-1-piperidyloxy) or BHT (2,6-di-*tert*-butyl-4-methyl-phenol), the reaction of **1a** with PIDA gave **2a** in 63% or 69% yield (versus 72% yield in the absence of a radical scavenger), implicating that a radical pathway was not involved in the reaction. A crossover experiment was performed by treatment of a mixture of **3a** and **3z8** in 1:1 molar ratio with PIDA under the standard conditions, affording a mixture of amides **4a** (74%) and **4z8** (68%), which suggests that the alkyl-thio group migration occurs via an intramolecular pathway (eq 3). Next, the role of the alkylthio group was identified. Treatment of enaminones **5a** and **5b** bearing no alkylthio group with PIDA gave none of the target amide products **6a** and **6b**. However, in the case of using aniline-derived enaminone **5b**, olefinic C–H acetoxylation proceeded to generate the acetoxylated enaminone **7b** (66%) without occurrence of the methyl group transfer (eq 4). These results have demonstrated that an alkylthio group at the *N*-attached terminus of the ketene moiety of enaminones **1** and **3** is crucial to assist the oxidative amidation.[12,16] In particular, treatment of **2o′** and **2u″** under the standard conditions formed the target products **2o** and **2u**, respectively, revealing that both **2o′** and **2u″** were the reaction intermediates. Deacetoxylation of *β*-vinyl-*α*,*β*-unsaturated amides **2w** and **2x** was carried out with K_2CO_3 in methanol at ambient temperature, forming *β*-hydroxy-2,4-dienamides **8a** (74%) and **8b** (71%), respectively, demonstrating a potential application of the resultant *α*,*β*-unsaturated amide products (eq 5).



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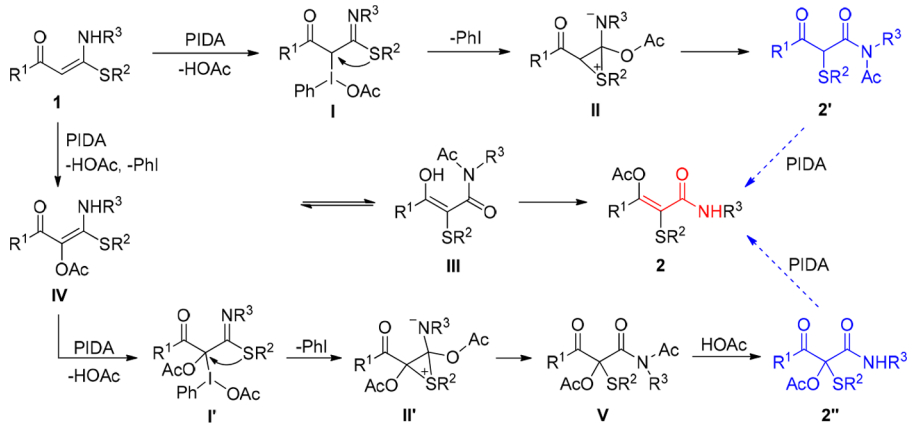
Scheme 5. Proposed Mechanism



A plausible mechanism is proposed in Scheme 5. Initially, enaminone **1** interacts with PIDA to form iodo(III) intermediate **I** with the release of acetic acid by deprotonation of the amino group. A redox process is followed to eliminate PhI and generate the three-membered alkylthionium species **II** through intramolecular partial alkylthio group migration and nucleophilic attack of OAc anion at the imino carbon. Ring-opening of alkylthionium ion **II** with 1,3-acetyl migration accomplishes the vicinal alkylthio group migration, affording intermediate species **2′**, which has been isolated and structurally identified by the X-ray single crystal structural determinations of **2o′** and **4s′**. Enolization of species **2′** followed by *N*-deacetylation/*O*-acetylation affords the target *α*,*β*-unsaturated amide product **2**. Alternatively, enaminone **1** reacts with PIDA to form the olefinic C−H acetoxylation intermediate **IV**,[16] which further interacts with PIDA to undergo deprotonative addition to give species **I′**. A process similar to the formation of alkylthionium species **II** occurs to generate species **II′**. Ring-opening of alkylthionium ion **II′** accompanied by 1,3-acetyl migration leads to species **V**, which then reacts with acetic acid generated in situ to afford intermediate species **2″**. Compounds **2″** were isolated and structurally confirmed by the X-ray single crystal structural analysis of **2p″** and **2u″**.

CONCLUSIONS

We have developed an amide bond formation protocol from readily available alkylthio-functionalized enaminones (*α*-oxo ketene *N*,*S*-acetals) with hypervalent iodine(III) reagents under mild conditions. Both primary and secondary amine-based enaminones can be employed as the substrates. Solventless mechanical milling can also be applied for the same purpose. Intramolecular vicinal alkylthio group migration is crucial for the amide bond formation, and the process tolerates a wide range of functional groups. The present work has provided a concise and convenient method to access multiply functionalized *α*,*β*-unsaturated amides including *β*-cyclopropylated acrylamides.

EXPERIMENTAL SECTION

General Considerations. The solvents were dried and distilled prior to use by the literature methods. ^{1}H and $^{13}C\{^{1}H\}$ NMR spectra were recorded on a 400 MHz NMR spectrometer, and all chemical shift values refer to δ_{TMS} = 0.00 ppm or $CDCl_3$ (δ (^{1}H), 7.26 ppm; δ (^{13}C), 77.16 ppm). The HRMS (EI) analysis was obtained on a Q-TOF mass spectrometer. Enantiomeric excess was determined by chiral HPLC analysis. Optical rotations were measured by a polarimeter. All melting points were uncorrected. Analytical TLC plates, Sigma-Aldrich silica gel 60_{F200}, were viewed by UV light at 254 nm. Column chromatographic purifications were performed on silica gel. All chemical reagents were purchased from commercial sources and used as received unless otherwise indicated. Known compounds **1a−c**,[22] **1d**, **1e**, and **1h**,[23] **1j**, **1k**, **1o**, **1r**, and **1z3**,[24] **1l** and **1m**,[25] **1w**, **1x**, and **1z5**,[26] **3s** and **3t**,[27] **5a**,[28] and **5b**[29] were prepared as reported. Compound **7b**[30] is known, and its spectroscopic feature is in good agreement with that reported in the literature.

*Typical Procedure for the Preparation of Enaminones (α-Oxo Ketene N,S-Acetals) **1a−u** and **1y−z1**: Synthesis of **1a**.* A mixture of *α*-oxo ketene *S*,*S*-acetal **sm1a** (448 mg, 2 mmol) and benzylamine (430 mg, 4 mmol) in EtOH (5 mL) was stirred at 80 °C overnight. After compound **sm1a** was completely consumed by TLC monitoring on silica gel, the resultant mixture was cooled to ambient temperature, and all volatiles evaporated under reduced pressure. Purification by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 30:1, v/v) afforded enaminone **1a** (489 mg, 86%) as a yellow solid.

*Typical Procedure for the Preparation of Enaminones **1z2−z4**: Synthesis of **1z2**.* In a fashion similar to the synthesis of enaminone **1a**, compound **sm1a** (448 mg, 2 mmol) reacted with diethylamine (295 mg, 4 mmol) in CH_3CN (5 mL) at 80 °C to afford enaminone **1z2** (280 mg, 53%) as a yellow liquid.

*Typical Procedure for the Preparation of Enaminones (α-Alkenoyl Ketene N,S-Acetals) **1v−x**: Synthesis of **1v**.* A mixture of $BF_3{\cdot}OEt_2$ (0.142 g, 1 mmol), compound **sm1v** (2.640 g, 10 mmol), and benzylamine (1.183 g, 11 mmol) in toluene (30 mL) was heated to reflux with stirring. When TLC monitoring on silica gel indicated the complete consumption of **sm1v**, the mixture was cooled to ambient temperature, and all volatiles evaporated under reduced pressure. Purification by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 30:1, v/v) afforded enaminone **1v** (2.200 g, 68%) as a yellow solid.

*Typical Procedure for the Preparation of Enaminones (α-Cyclopropyl-carbonyl Ketene N,S-Acetals) **3a−z19**: Synthesis of **3w**.* A mixture of compound **sm3w** (500 mg, 2 mmol), trimethylsulfoxonium iodide (440 mg, 2 mmol), NaOH (800 mg, 20 mmol), and tetrabutylammonium bromide (322, 1 mmol) in 20 mL of CH_2Cl_2/H_2O (v/v = 1:1) was stirred at 50 °C overnight. After TLC monitoring on silica gel indicated the complete consumption of compound **sm3w**, the mixture was cooled to ambient temperature. The organic phase was separated and dried over anhydrous Na_2SO_4, and all volatiles evaporated under reduced pressure. The resultant residue was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v), affording *α*-oxo ketene dithioacetal **sm3w′** (423 mg, 80%) as a white solid. The preparation of enaminone **3w** was accomplished from the reaction of **sm3w′** with benzylamine by following the procedure used for the synthesis of enaminone **1a**.

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J. Org. Chem. 2018, 83, 5731−5750

*Preparation of ^{13}C-Labeled α-Oxo Ketene S,S-Acetal **sm1a**[^{13}C].* Iodomethane (4.260 g, 30 mmol) was added dropwise to a stirred mixture of aceto-^{13}C-phenone (**sm2**) (1.170 g, 10 mmol), NaH (0.800 g, 60% in oil, 20 mmol), CS_2 (1.145 g, 15 mmol), and DMF (1 mL) in 19 mL of toluene at 0 °C. The reaction was continued for 24 h. The resulting mixture was poured into 20 g of ice water and extracted with CH_2Cl_2 (3 × 15 mL). The combined organic phase was dried over anhydrous Na_2SO_4 and filtered. All volatiles were removed under reduced pressure, and the residue was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 30:1, v/v), affording **sm1a**[^{13}C] (1.600 g, 71%) as a yellow solid.

*Preparation of ^{13}C-Labeled Enaminone **1c**[^{13}C].* In a fashion similar to the preparation of enaminone **1a**, a mixture of α-oxo ketene *S,S*-acetal **sm1a**[^{13}C] (225 mg, 1 mmol) and ethylamine (370 mg, 5 mmol) in EtOH (5 mL) was stirred at 80 °C overnight. After compound **sm1a**[^{13}C] was completely consumed by TLC monitoring on silica gel, the mixture was cooled to ambient temperature, and all volatiles evaporated under reduced pressure. The resultant residue was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 30:1, v/v), affording **1c**[^{13}C] (192 mg, 87%) as a colorless liquid.

*Typical Procedure for the Synthesis of α,β-Unsaturated Amides **2** and **4**: Synthesis of (E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2a**).* $PhI(OAc)_2$ (242 mg, 0.75 mmol) was added to a stirred solution of enaminone **1a** (142 mg, 0.5 mmol) in 1,2-dichloroethane (DCE) (5 mL), and the reaction was continued at ambient temperature for 2 h until compound **1a** was completely consumed by TLC monitoring on silica gel. The resultant mixture was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) to afford amide **2a** (123 mg, 72%) as a white solid.

*Typical Procedure for the Synthesis of α,β-Unsaturated Aamides **2** under the Solventless Mechanical Milling Conditions: Synthesis of **2a**.* A mixture of $PhI(OAc)_2$ (194 mg, 0.6 mmol) and enaminone **1a** (142 mg, 0.5 mmol) was mechanically milled in a 5 mL glass vial by a glass rod for 5 min, and the resultant yellow liquid mixture was allowed to stay in air at ambient temperature without milling for about 2 h until compound **1a** was completely consumed by TLC monitoring on silica gel. The resulting mixture was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) to afford amide **2a** (125 mg, 73%) as a white solid.

*Gram Scale Preparation: Synthesis of (E)-3-(Ethylamino)-2-(ethylthio)-3-oxo-1-phenylprop-1-enyl Acetate (**2s**).* $PhI(OAc)_2$ (2.42 g, 7.5 mmol) was added to a stirred solution of enaminone **1s** (1.18 g, 5 mmol) in 1,2-dichloroethane (10 mL) at ambient temperature, and the reaction was continued for 2 h until compound **1s** was completely consumed by TLC monitoring on silica gel. The resultant mixture was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) to afford amide **2s** (1.06 g, 72%) as a white solid.

^{18}O-Labeling Experiment. A mixture of Ac_2O (62 mg, 0.6 mmol) and $H_2{}^{18}O$ (20 mg, 0.5 mmol, 90% ^{18}O) was stirred at 60 °C for 30 min. After the mixture cooled to ambient temperature, 1,2-dichloroethane (2 mL), enaminone **1f** (89 mg, 0.3 mmol), and $PhI(OAc)_2$ (145 mg, 0.45 mmol) were successively added with stirring. The reaction was continued at ambient temperature for 2 h until compound **1f** was completely consumed by TLC monitoring on silica gel. The resultant mixture was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) to afford a 72:28 molar ratio mixture of the target amide product **2f** and ^{18}O-labeled amide product **2f**[^{18}O] as a white solid (76%). Amide **2f**[^{18}O] was identified by the HRMS analysis, whereas amide **2f**[^{18}OAc] was not detected in the reaction mixture.

Radical Trapping Experiments. $PhI(OAc)_2$ (242 mg, 0.75 mmol) was added to a stirred mixture of enaminone **1a** (142 mg, 0.5 mmol) and TEMPO (2,2,6,6-tetramethyl-1-piperidyloxy) or BHT (2,6-di-*tert*-butyl-4-methylphenol) (1.5 mmol) in 1,2-dichloro-ethane (5 mL) at ambient temperature, and the reaction was continued for 2 h until **1a** was completely consumed by TLC monitoring on silica gel. The resultant mixture was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) to afford **2a** as a white solid (65% or 69%).

Crossover Experiment. $PhI(OAc)_2$ (484 mg, 1.50 mmol) was added to a stirred mixture of enaminones **3a** (124 mg, 0.5 mmol) and **3z8** (169 mg, 0.5 mmol) in 1,2-dichloroethane (5 mL) at ambient temperature. The reaction was continued for 2 h until compounds **3a** and **3z8** were completely consumed by TLC monitoring on silica gel. The resultant mixture was purified by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) to afford **4a** (113 mg, 74%) and **4z8** (134 mg, 68%), respectively.

*Reactions of Enaminones **5** with $PhI(OAc)_2$: Synthesis of (E)-1-Oxo-1-phenyl-3-(phenylamino)but-2-en-2-yl Acetate (**7b**).* $PhI(OAc)_2$ (242 mg, 0.75 mmol) was added to a stirred mixture of (*Z*)-1-phenyl-3-(phenylamino)but-2-en-1-one (**5b**) (119 mg, 0.5 mmol) in 1,2-dichloroethane (5 mL) at ambient temperature. The reaction was continued for 2 h until compound **5b** was completely consumed by TLC monitoring on silica gel. Purification of the resultant mixture by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 10:1, v/v) afforded **7b** (97 mg, 66%) as a white solid. The target amide product **6b** was not detected in the reaction mixture.

*Deacetoxylation with K_2CO_3: Synthesis of (2E,4E)-N-Benzyl-3-hydroxy-5-(4-methoxyphenyl)-2-(thiomethyl)penta-2,4-dienamide (**8a**).* A mixture of amide **2l** (119 mg, 0.3 mmol) and K_2CO_3 (21 mg, 0.15 mmol) in MeOH (3 mL) was stirred at ambient temperature for 5 min. Then 10 mL of water was added, and the mixture was extracted with CH_2Cl_2 (3 × 10 mL). The combined organic phase was dried over anhydrous Na_2SO_4 and filtered. All volatiles were evaporated under reduced pressure. Purification by silica gel column chromatography (eluent = petroleum ether (60−90 °C)/AcOEt = 50:1, v/v) gave **8a** (79 mg, 74%) as a yellow solid.

*(E)-3-(Ethylamino)-3-(thiomethyl)-1-phenylprop-2-en-1-one-^{13}C (**1c**[^{13}C]):* 192 mg, yield 87%, yellow liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 11.78 (br s, 1H), 7.83, 7.37 (m each, 2:3H), 5.61 (d, *J* = 2.0 Hz, 1H), 3.38 (m, 2H), 2.40 (s, 3H), 1.29 (t, *J* = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 185.0, 169.3, 140.7 (d, *J* = 54.5 Hz), 130.3, 128.1 (d, *J* = 3.8 Hz), 126.8 (d, *J* = 2.4 Hz), 85.9 (d, *J* = 63.9 Hz), 38.7, 14.8, 14.1; HRMS (EI) calcd for $C_{11}{}^{13}CH_{16}NOS$ [M + H]$^+$ 223.0986, found 223.0982.

*(E)-3-(Thiomethyl)-1-phenyl-3-(1-phenylethylamino)prop-2-en-1-one (**1f**):* 2.14 g, yield 72%, yellow solid, mp 80−82 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 12.35 (d, *J* = 6.8 Hz, 1H), 7.87, 7.42, 7.35, 7.27 (m each, 2:3:4:1H), 5.68 (s, 1H), 4.90 (m, 1H), 2.40 (s, 3H), 1.64 (d, *J* = 6.8 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 185.6, 169.0, 143.5, 40.8, 130.7, 128.9, 128.4, 127.5, 127.1, 126.1, 86.9, 54.3, 24.6, 14.7; HRMS (EI) calcd for $C_{18}H_{20}NOS$ [M + H]$^+$ 298.1266, found 298.1266.

*(E)-3-(Benzhydrylamino)-3-(thiomethyl)-1-phenylprop-2-en-1-one (**1g**):* 1.04 g, yield 29%, white solid, mp 125−128 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 12.75 (d, *J* = 7.8 Hz, 1H), 7.90 (dd, *J* = 7.9, 1.7 Hz, 2H), 7.45, 7.38, 7.31 (m each, 3:8:2H), 6.05 (d, *J* = 8.1 Hz, 1H), 5.78 (s, 1H), 2.46 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 185.9, 168.8, 141.4, 140.7, 130.8, 129.0, 128.4, 127.8, 127.4, 127.2, 87.5, 62.4, 14.8; HRMS (EI) calcd for $C_{23}H_{22}NOS$ [M + H]$^+$ 360.1422, found 360.1420.

*(E)-3-(Thiomethyl)-1-phenyl-3-((tetrahydrofuran-2-yl)-methylamino)prop-2-en-1-one (**1i**):* 1.99 g, yield 72%, yellow liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 11.85 (t, 1H), 7.75, 7.25 (m each, 2:3H), 5.54 (s, 1H), 4.96 (m, 1H), 3.32 (m, 2H), 1.79, 1.51 (m each, 1:2:3:1H), 3.80, 3.63 (dd each, *J* = 14.7, 7.0 Hz, 1:1H), 2.27 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 184.6, 169.0, 140.2, 129.9, 127.7, 126.4, 86.1, 76.6, 67.9, 28.5, 25.4, 47.4, 13.8; HRMS (EI) calcd for $C_{15}H_{20}NO_2S$ [M + H]$^+$ 278.1215, found 278.1215.

*(E)-3-(Ethylamino)-1-(3-fluorophenyl)-3-(thiomethyl)prop-2-en-1-one (**1n**):* 1.70 g, yield 71%, colorless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 11.68 (br s, 1H), 7.50 (d, *J* = 7.8 Hz), 7.44, 7.22, 6.98 (1:1:1:1H), 5.47 (s, 1H), 3.29 (m, 2H), 2.32 (s, 3H), 1.20 (t, *J* = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 183.0 (d, *J* = 2.1 Hz), 169.9, 162.7 (d, *J* = 245.9 Hz), 143.1 (d, *J* = 6.2 Hz), 129.6 (d, *J* = 7.8 Hz), 122.3 (d, *J* = 2.8 Hz), 117.0 (d, *J* = 21.5 Hz), 113.6 (d, *J* = 22.1

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Hz), 85.8, 38.7, 14.6, 14.1; HRMS (EI) calcd for $C_{12}H_{15}NOSF$ $[M + H]^+$ 240.0858, found 240.0858.

(E)-3-(Ethylamino)-3-(thiomethyl)-1-(4-(trifluoromethyl)phenyl)-prop-2-en-1-one (**1p**): 1.82 g, yield 63%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.83 (br s, 1H), 7.90, 7.61 (d each, J = 8.1 Hz, 2:2H), 5.58 (s, 1H), 3.39 (m, 2H), 2.42 (s, 3H), 1.30 (t, J = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 183.2, 170.4, 144.1, 131.8 (q, J = 32.4 Hz), 127.16, 125.18 (q, J = 3.8 Hz), 124.1 (q, J = 272.3 Hz), 86.2, 38.9, 14.7, 14.2; HRMS (EI) calcd for $C_{13}H_{15}NOSF_3$ $[M + H]^+$ 290.0826, found 290.0826.

(E)-3-(Ethylamino)-1-(furan-2-yl)-3-(thiomethyl)prop-2-en-1-one (**1q**): 1.90 g, yield 90%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.39 (br s, 1H), 7.33 (m, 1H), 6.88 (dd, J = 3.4, 0.5 Hz, 1H), 6.34 (dd, J = 3.4, 1.7 Hz, 1H), 5.52 (s, 1H), 3.27 (m, 2H), 2.33 (s, 3H), 1.17 (t, J = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 174.3, 169.5, 154.3, 143.4, 111.8, 111.6, 85.1, 38.6, 14.5, 14.0; HRMS (EI) calcd for $C_{10}H_{14}NO_2S$ $[M + H]^+$ 212.0745, found 212.0740.

(E)-3-(Ethylamino)-3-(thioethyl)-1-phenylprop-2-en-1-one (**1s**): 1.20 g, yield 51%, colorless liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.82 (br s, 1H), 7.82, 7.37 (m each, 2:3H), 5.67 (s, 1H), 3.39 (m, 2H), 2.95 (m, 2H), 1.38 (t, J = 7.2 Hz, 3H), 1.29 (t, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 185.0, 168.5, 140.8, 130.3, 128.2, 126.8, 86.7, 38.7, 25.6, 14.8, 13.6; HRMS (EI) calcd for $C_{13}H_{18}NOS$ $[M + H]^+$ 236.1109, found 236.1110.

(E)-3-(Thioethyl)-1-phenyl-3-(1-phenylethylamino)prop-2-en-1-one (**1t**): 2.39 g, yield 77%, yellow solid, mp 106−108 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 12.48 (d, J = 7.3 Hz, 1H), 7.92, 7.45, 7.39, 7.30 (m each, 2:3:4:1H), 5.78 (s, 1H), 4.98 (m, J = 6.9 Hz, 1H), 2.95 (m, 2H), 1.67 (d, J = 6.8 Hz, 3H), 1.38 (t, J = 7.4 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 185.3, 168.0, 143.4, 140.6, 130.5, 128.7, 128.2, 127.3, 126.9, 125.9, 87.4, 54.1, 26.0, 24.4, 13.5; HRMS (EI) calcd for $C_{19}H_{22}NOS$ $[M + H]^+$ 312.1422, found 312.1426.

(E)-3-(Benzylthio)-3-(ethylamino)-1-phenylprop-2-en-1-one (**1u**): 1.72 g, yield 58%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.63 (br s, 1H), 7.64, 7.18 (m each, 2:8H), 5.60 (s, 1H), 4.01 (s, 2H), 3.24 (m, 2H), 1.12 (t, J = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 185.2, 167.9, 140.6, 134.8, 130.4, 128.9, 128.8, 128.1, 127.9, 126.8, 87.6, 38.8, 36.2, 14.9; HRMS (EI) calcd for $C_{18}H_{20}NOS$ $[M + H]^+$ 298.1266, found 298.1267.

(1E,4E)-1-(Benzylamino)-1-(thiomethyl)-5-p-tolylpenta-1,4-dien-3-one (**1v**): 1.52 g, yield 47%, yellow solid, mp 81−84 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 12.28 (br s, 1H), 7.51, 6.65 (d each, J = 15.7 Hz, 1:1H), 7.40, 7.12 (d each, J = 8.0 Hz, 2:2H), 7.30, 7.23 (m each, 4:1H), 5.16 (s, 1H), 4.52 (m, 2H), 2.34 (s, 3H), 2.31 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 183.0, 169.3, 139.1, 137.6, 127.5, 137.1, 133.1, 129.4, 128.7, 127.7, 127.2, 91.5, 47.8, 21.3, 14.2; HRMS (EI) calcd for $C_{20}H_{22}NOS$ $[M + H]^+$ 324.1422, found 324.1415.

(E)-4-(Benzylamino)-4-(thiomethyl)but-3-en-2-one (**1y**): 1.10 g, yield 50%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.68 (br s, 1H), 7.36−7.25 (m, 5H), 5.03 (d, J = 2.4 Hz, 1H), 4.53 (t, 2H), 2.34 (dd, J = 6.5, 1.5 Hz, 3H), 2.08 (d, J = 2.5 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.1, 167.9, 137.4, 128.6, 127.4, 127.1, 89.7, 47.5, 29.0, 14.2; HRMS (EI) calcd for $C_{12}H_{16}NOS$ $[M + H]^+$ 222.0953, found 222.0953.

(E)-4-(Thiomethyl)-4-(4-(trifluoromethyl)benzylamino)but-3-en-2-one (**1z**): 1.01 g, yield 35%, yellow solid, mp 66−67 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.69 (br s, 1H), 7.53, 7.35 (d, J = 8.2 Hz, 2:2H), 5.01 (s, 1H), 4.52 (d, J = 6.3 Hz, 2H), 2.28 (s, 3H), 2.03 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.9, 167.9, 141.7, 129.6 (q, J = 32.4 Hz), 127.2, 125.5 (q, J = 3.8 Hz), 124.0 (q, J = 272.1 Hz), 90.2, 46.9, 29.0, 14.0; HRMS (EI) calcd for $C_{13}H_{15}NOSF_3$ $[M + H]^+$ 290.0826, found 290.0827.

(E)-4-(Thiomethyl)-4-(1-phenylethylamino)but-3-en-2-one (**1z1**): 1.53 g, yield 65%, yellow solid, mp 51−54 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.86 (br s, 1H), 7.36, 7.30 (m each, 2:3H), 5.00 (s, 1H), 4.83 (p, J = 6.9 Hz, 1H), 2.30 (s, 3H), 2.11 (s, 3H), 1.59 (d, J = 6.8 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.2, 167.4, 143.6, 128.8, 127.3, 125.9, 89.6, 53.9, 29.2, 24.6, 14.4; HRMS (EI) calcd for $C_{13}H_{18}NOS$ $[M + H]^+$ 236.1109, found 236.1112.

(E)-3-(Diethylamino)-3-(thiomethyl)-1-phenylprop-2-en-1-one (**1z2**): 1.39 g, yield 56%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.83, 7.36 (m each, 2:3H), 5.83 (s, 1H), 3.55 (m, 4H), 2.45 (s, 3H), 1.20 (m, 6H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 184.3, 169.3, 142.3, 130.2, 128.0, 127.3, 92.9, 47.0, 18.2, 13.3; HRMS (EI) calcd for $C_{14}H_{20}NOS$ $[M + H]^+$ 250.1266, found 250.1273.

(E)-1-(4-Chlorophenyl)-3-(diethylamino)-3-(thiomethyl)prop-2-en-1-one (**1z4**): 1.22 g, yield 43%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.76, 7.33 (d each, J = 8.5 Hz, 2:2H), 5.76 (s, 1H), 3.57 (m, 4H), 2.46 (s, 3H), 1.21 (m, 6H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 182.7, 169.9, 140.7, 136.3, 128.8, 128.3, 92.4, 47.2, 18.3, 13.4; HRMS (EI) calcd for $C_{14}H_{19}NOSCl$ $[M + H]^+$ 284.0876, found 284.0876.

(E)-3-((Z)-3,7-Dimethylocta-2,6-dienylamino)-3-(thiomethyl)-1-phenylprop-2-en-1-one (**1z6**): 409 mg, yield 62%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.73 (t, 1H), 7.78 (dd, J = 7.2, 2.4 Hz, 2H), 7.27 (m, 3H), 5.55 (s, 1H), 5.24, 5.02 (t, 1:1H), 3.87 (t, 2H), 2.28 (s, 3H), 2.03 (dd, J = 14.8, 6.5 Hz, 2H), 1.95 (m, 2H), 1.61, 1.60, 1.53 (s each, 3:3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 184.4, 168.7, 140.4, 139.9, 131.2, 130.0, 127.8, 126.5, 123.5, 118.8, 85.7, 41.5, 39.1, 26.0, 25.3, 17.3, 16.0, 13.9; HRMS (EI) calcd for $C_{20}H_{28}NOS$ $[M + H]^+$ 330.1892, found 330.1887.

(E)-3-(Thiomethyl)-3-(8-((E)-1-(thiomethyl)-3-oxo-3-phenylprop-1-enylamino)octylamino)-1-phenylprop-2-en-1-one (**1z7**): 883 mg, yield 89%, white solid, mp 125−127 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.87 (s, 2H), 7.84, 7.39 (m each, 4:6H), 5.63 (s, 2H), 3.37 (dd, J = 12.8, 6.8 Hz, 4H), 2.46 (s, 6H), 1.69, 1.42, 1.37 (m, 4:4:4H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 185.2, 169.6, 140.9, 130.5, 128.3, 127.0, 86.2, 44.2, 29.6, 29.1, 26.9, 14.4; HRMS (EI) calcd for $C_{28}H_{37}N_2O_2S_2$ $[M + H]^+$ 497.2296, found 497.2299.

(S,E)-Methyl 2-(1-(Thiomethyl)-3-oxo-3-phenylprop-1-enylamino)propanoate (**1z8**): 1.14 g, yield 41%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.97 (d, J = 8.0 Hz, 1H), 7.78, 7.29 (m each, 2:3H), 5.62 (s, 1H), 4.34 (m, 1H), 3.63 (s, 3H), 2.31 (s, 3H), 1.45 (d, J = 7.0 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 185.3, 171.7, 167.7, 139.9, 130.3, 127.8, 126.6, 87.1, 52.1, 51.9, 18.7, 14.0; HRMS (EI) calcd for $C_{14}H_{18}NO_3S$ $[M + H]^+$ 280.1007, found 280.1009.

(R,E)-1-(4-Chlorophenyl)-3-(thiomethyl)-3-(1-phenylethylamino)-prop-2-en-1-one (**1z9**): 2.55 g, yield 77%, yellow solid, mp 75−76 °C, 99% ee, $[\alpha]_D^{20}$ +573.56 (c 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 12.37 (d, J = 6.6 Hz, 1H), 7.82 (d, J = 8.5 Hz, 2H), 7.36, 7.27 (m each, 6:1H), 5.62 (s, 1H), 4.90 (p, J = 6.9 Hz, 1H), 2.38 (s, 3H), 1.64 (d, J = 6.8 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 183.9, 169.3, 143.2, 139.0, 136.6, 128.8, 128.4, 128.3, 127.5, 125.9, 86.4, 54.2, 24.5, 14.6; HRMS (EI) calcd for $C_{18}H_{19}NOSCl$ $[M + H]^+$ 332.0876, found 332.0882; HPLC (OG-H column, *i*PrOH/*n*-hexane 10:90, 0.7 mL/min, 254 nm) t_1 = 9.92 min (major), t_2 = 14.94 min.

(S,E)-3-(Thiomethyl)-3-(1-phenylethylamino)-1-(thiophen-2-yl)-prop-2-en-1-one (**1z10**): 1.79 g, yield 59%, yellow solid, mp 108−111 °C, 98% ee, $[\alpha]_D^{20}$ −635.06 (c 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 11.86 (d, J = 7.1 Hz, 1H), 7.44 (d, J = 3.6 Hz, 1H), 7.32 (d, J = 4.9 Hz, 1H), 7.23, 7.15 (m each, 4:1H), 6.95 (m, 1H), 5.46 (s, 1H), 4.76 (p, J = 6.9 Hz, 1H), 2.25 (s, 3H), 1.50 (d, J = 6.8 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 178.4, 168.6, 147.1, 143.3, 129.7, 128.8, 127.7, 127.3, 127.2, 125.9, 86.3, 54.1, 24.5, 14.5; HRMS (EI) calcd for $C_{16}H_{18}NOS_2$ $[M + H]^+$ 304.0830, found 304.0826; HPLC (OG-H column, *i*PrOH/hexane 15:85, 0.8 mL/min, 254 nm) t_1 = 9.62 min (major), t_2 = 15.69 min.

(1E,4E)-1-(Thiomethyl)-1-((S)-1-phenylethylamino)-5-o-tolylpenta-1,4-dien-3-one (**1z11**): 1.41 g, yield 42%, yellow liquid, 99% ee, $[\alpha]_D^{20}$ +671.54 (c 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 12.56 (d, J = 7.7 Hz, 1H), 7.93, 6.68 (d each, J = 15.5 Hz, 1:1H), 7.62 (d, J = 7.4 Hz, 1H), 7.35 (d, J = 4.4 Hz, 4H), 7.26, 7.20 (m, 1:3H), 5.17 (s, 1H), 4.87 (p, J = 6.8 Hz, 1H), 2.49 (s, 3H), 2.28 (s, 3H), 1.63 (d, J = 6.8 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 182.4, 168.9, 143.0, 137.2, 134.6, 135.0, 127.2, 130.5, 129.5, 128.7, 128.6, 125.9, 125.8, 125.7, 91.6, 54.0, 24.3, 19.8, 14.1; HRMS (EI) calcd for $C_{21}H_{24}NOS$ $[M + H]^+$ 338.1579, found 338.1580; HPLC (OD-H column, *i*PrOH/hexane 30:70, 0.7 mL/min, 230 nm) t_1 = 5.8 min (major), t_2 = 15.3 min.

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J. Org. Chem. 2018, 83, 5731−5750

*(1E,4E)-5-(4-Chlorophenyl)-1-(thiomethyl)-1-((R)-1-phenylethylamino)penta-1,4-dien-3-one (**1z12**):* 0.75 g, yield 21%, yellow liquid, 99% ee, $[\alpha]_D^{20}$ −237.71 (*c* 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 12.53 (d, *J* = 7.6 Hz, 1H), 7.52, 6.67 (d each, *J* = 15.7 Hz, 1:1H), 7.45 (d, *J* = 8.5 Hz, 2H), 7.33, 7.26 (m each, 6:1H), 5.13 (s, 1H), 4.85 (q, *J* = 6.8 Hz, 1H), 2.33 (s, 3H), 1.61 (d, *J* = 6.8 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 182.2, 169.4, 143.2, 134.8, 134.5, 136.2, 127.4, 129.1, 129.0, 128.9, 128.8, 125.9, 91.7, 54.3, 24.5, 14.5; HRMS (EI) calcd for $C_{20}H_{21}NOSCl$ $[M + H]^+$ 358.1032, found 358.1033; HPLC (AD-H column, *i*PrOH/hexane 3:97, 0.7 mL/min, 254 nm) t_1 = 10.0 min (major), t_2 = 11.1 min.

*(E)-3-(((1R,4aS,10aR)-7-Isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methylamino)-3-(thiomethyl)-1-phenylprop-2-en-1-one (**1z13**):* 489 mg, yield 53%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 12.31 (br s, 1H), 7.93, 7.46, 7.26 (m each, 2:3:1H), 7.08 (d, *J* = 8.1 Hz, 1H), 6.99 (s, 1H), 5.73 (d, *J* = 2.1 Hz, 1H), 3.46 (dd, *J* = 13.0, 6.3 Hz, 1H), 3.31 (dd, *J* = 13.1, 5.8 Hz, 1H), 3.03 (s, 2H), 2.91 (m, 1H), 2.51 (s, 3H), 2.39 (d, *J* = 12.8 Hz, 1H), 1.92 (dd, *J* = 10.5, 7.0 Hz, 2H), 1.84 (d, *J* = 11.7 Hz, 2H), 1.80 (s, 1H), 1.66 (d, *J* = 11.4 Hz, 1H), 1.56 (s, 1H), 1.53 (d, *J* = 2.3 Hz, 2H), 1.33, 1.31 (3:3H), 1.14 (s, 3H), 0.97 (m, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 185.2, 169.9, 147.0, 145.6, 140.8, 134.6, 130.4, 128.2, 126.9, 126.8, 124.3, 123.9, 86.5, 56.1, 46.4, 38.2, 38.0, 37.6, 36.4, 33.5, 30.3, 26.9, 25.5, 24.0, 19.4, 18.7, 18.3, 14.4; HRMS (EI) calcd for $C_{30}H_{40}NOS$ $[M + H]^+$ 462.2831, found 462.2833.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2a**):* 123 mg, yield 72%, white solid, mp 101−104 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.53, 7.37, 7.30 (m each, 2:7:1H), 6.73 (br s, 1H), 4.53 (d, *J* = 6.0 Hz, 2H), 2.21 (s, 3H), 1.98 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 164.2, 148.8, 138.2, 134.3, 129.7, 128.9, 128.8, 128.21, 128.20, 127.8, 122.2, 43.9, 20.8, 17.0; HRMS (EI) calcd for $C_{19}H_{20}NO_3S$ $[M + H]^+$ 342.1164, found 342.1160.

*(E)-3-(Methylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2b**):* 80 mg, yield 60%, white solid, mp 106−109 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.54, 7.37 (m each, 2:3H), 6.46 (br s, 1H), 2.91 (d, *J* = 5.0 Hz, 3H), 2.21 (s, 3H), 2.17 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 165.0, 149.2, 134.4, 129.6, 128.8, 128.2, 122.1, 26.7, 21.0, 17.1; HRMS (EI) calcd for $C_{13}H_{15}NO_3SNa$ $[M + Na]^+$ 288.0670, found 288.0670.

*(E)-3-(Ethylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2c**):* 116 mg, yield 83%, white solid, mp 109−112 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.52, 7.34 (m each, 2:3H), 6.42 (br s, 1H), 3.35 (p, *J* = 6.9 Hz, 2H), 2.19 (s, 3H), 2.13 (s, 3H), 1.16 (t, *J* = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.2, 164.0, 147.8, 134.2, 129.4, 128.6, 128.0, 122.5, 34.6, 20.9, 16.7, 14.9; HRMS (EI) calcd for $C_{14}H_{17}NO_3SNa$ $[M + Na]^+$ 302.0827, found 302.0824.

*(E)-3-(Ethylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate-^{13}C (**2c**[^{13}C]):* 104 mg, yield 74%, white solid, mp 118−121 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.53, 7.36 (m each, 2:3H), 6.41 (br s, 1H), 3.37 (m, 2H), 2.21 (s, 3H), 2.15 (s, 3H), 1.18 (t, *J* = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4 (d, *J* = 4.2 Hz), 164.1, 148.1, 134.2 (d, *J* = 67.7 Hz), 129.6 (d, *J* = 0.9 Hz), 128.7 (d, *J* = 1.6 Hz), 128.2 (d, *J* = 4.5 Hz), 122.5 (d, *J* = 91.8 Hz), 34.7, 21.0 (d, *J* = 1.9 Hz), 16.8 (d, *J* = 2.3 Hz), 15.0; ^{13}C DEPT135 NMR (100 MHz, $CDCl_3$) δ 148.0, 129.5 (d, *J* = 0.9 Hz), 128.6 (d, *J* = 1.7 Hz), 128.1 (d, *J* = 4.5 Hz), 34.6, 20.9 (d, *J* = 2.0 Hz), 16.8 (d, *J* = 2.3 Hz), 14.9; HRMS (EI) calcd for $C_{13}{}^{13}CH_{17}NO_3SNa$ $[M + Na]^+$ 303.0860, found 303.0856.

*(E)-3-(Butylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2d**):* 132 mg, yield 86%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.52, 7.35 (m each, 2:3H), 6.41 (br s, 1H), 3.32 (q, *J* = 6.6 Hz, 2H), 2.20 (d, *J* = 0.6 Hz, 3H), 2.14 (d, *J* = 0.6 Hz, 3H), 1.52 (m, 2H), 1.37 (m, 2H), 0.93 (t, *J* = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.3, 164.1, 147.9, 134.2, 129.5, 128.6, 128.1, 122.5, 39.5, 31.7, 20.9, 20.1, 16.8, 13.7; HRMS (EI) calcd for $C_{16}H_{22}NO_3S$ $[M + H]^+$ 308.1320, found 308.1316.

*(E)-3-(Cyclohexylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2e**):* 132 mg, yield 79%, white solid, mp 120−121 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.53 (dd, *J* = 7.6, 1.9 Hz, 2H), 7.34 (m, 3H), 6.22 (d, *J* = 8.0 Hz, 1H), 3.85 (m, 1H), 2.21 (s, 3H), 2.14 (s, 3H), 1.93, 1.71, 1.61, 1.38, 1.18 (m each, 2:2:1:2:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 163.0, 146.9, 134.1, 129.4, 128.6, 128.1, 122.9, 48.4, 33.1, 25.5 24.8, 20.9, 16.5; HRMS (EI) calcd for $C_{18}H_{24}NO_3S$ $[M + H]^+$ 334.1477, found 334.1481.

*(E)-2-(Thiomethyl)-3-oxo-1-phenyl-3-(1-phenylethylamino)prop-1-enyl Acetate (**2f**):* 151 mg, yield 85%, white solid, mp 128−131 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.56, 7.39, 7.30 (m each, 3:6:1H), 6.63 (d, *J* = 7.9 Hz, 1H), 5.27 (m, 1H), 2.21 (s, 3H), 1.99 (s, 3H), 1.57 (d, *J* = 6.9 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 163.2, 147.4, 142.8, 134.1, 129.5, 128.8, 128.6, 128.1, 127.6, 126.4, 122.6, 49.0, 21.8, 20.7, 16.6; HRMS (EI) calcd for $C_{20}H_{22}NO_3S$ $[M + H]^+$ 356.1320, found 356.1314.

*(Z)-3-(Benzhydrylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2g**):* 188 mg, yield 90%, white solid, mp 128−130 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.88, 7.71, 7.62 (m each, 2:7:6H), 7.34 (d, *J* = 8.7 Hz, 1H), 6.73 (d, *J* = 8.7 Hz, 1H), 2.52 (s, 3H), 2.22 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.6, 163.5, 148.2, 141.4, 128.9, 128.8, 128.2, 127.7, 127.6, 134.2, 129.7, 122.4, 57.0, 20.7, 16.9; HRMS (EI) calcd for $C_{25}H_{24}NO_3S$ $[M + H]^+$ 418.1477, found 418.1472.

*(E)-3-(allylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2h**):* 108 mg, yield 74%, white solid, mp 89−92 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.54, 7.39 (m each, 2:3H), 6.51 (br s, 1H), 5.88 (m, 1H), 5.26 (dd, *J* = 17.2, 1.4 Hz, 1H), 5.19 (dd, *J* = 10.2, 1.2 Hz, 1H), 3.98 (m, 2H), 2.23 (s, 3H), 2.16 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 164.2, 149.1, 134.3, 133.9, 117.1, 129.7, 128.8, 128.2, 122.1, 42.3, 21.1, 17.1; HRMS (EI) calcd for $C_{15}H_{17}NO_3SNa$ $[M + Na]^+$ 314.0827, found 314.0823.

*(E)-2-(Thiomethyl)-3-oxo-1-phenyl-3-((tetrahydrofuran-2-yl)-methylamino)prop-1-enyl Acetate (**2i**):* 141 mg, yield 84%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.52, 7.35 (m each, 2:3H), 6.76 (br s, 1H), 3.85 3.73 (dd, *J* = 15.0, 7.0 Hz, 1:1H), 3.99 (m, 1H), 3.62, 3.21 (m each, 1:1H), 1.97, 1.87, 1.55 (m each, 1:2:1H), 2.20 (s, 3H), 2.14 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.1, 164.3, 149.0, 134.4, 129.5, 128.7, 128.1, 122.2, 77.5, 68.1, 28.8, 25.8, 43.6, 20.9, 16.9; HRMS (EI) calcd for $C_{17}H_{22}NO_4S$ $[M + H]^+$ 336.1270, found 336.1275.

*(Z)-3-(Furan-2-ylmethylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2j**):* 121 mg, yield 73%, white solid, mp 99−102 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.54, 7.37 (m each, 1:4H), 7.53, 6.33 (d, *J* = 1.9 Hz, 1:1H), 6.72 (br s, 1H), 6.29 (d, *J* = 3.1 Hz, 1H), 4.52 (d, *J* = 5.8 Hz, 2H), 2.19 (s, 3H), 2.07 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 164.0, 151.1, 148.8, 142.4, 110.7, 107.9, 134.2, 129.6, 128.7, 128.2, 122.0, 36.7, 20.8, 16.8; HRMS (EI) calcd for $C_{17}H_{17}NO_4SNa$ $[M + Na]^+$ 354.0776, found 354.0773.

*(E)-3-(Benzylamino)-1-(2-chlorophenyl)-2-(thiomethyl)-3-oxo-prop-1-enyl Acetate (**2k**):* 158 mg, yield 84%, white solid, mp 117−119 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.49, 7.42, 7.36, 7.31, 7.27 (m each, 1:1:4:2:1H), 6.85 (br s, 1H), 4.55 (d, *J* = 6.0 Hz, 2H), 2.19 (s, 3H), 1.99 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.9, 163.5, 148.0, 138.2, 133.7, 133.6, 131.6, 130.7, 129.8, 129.0, 128.2, 127.8, 126.7, 124.9, 44.0, 20.8, 16.9; HRMS (EI) calcd for $C_{19}H_{19}NO_3SCl$ $[M + H]^+$ 376.0774, found 376.0773.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-p-tolylprop-1-enyl Acetate (**2l**):* 144 mg, yield 81%, white solid, mp 139−142 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.46, 7.20 (d each, *J* = 8.1 Hz, 2:2H), 7.37, 7.32 (m each, 4:1H), 6.75 (s, 1H), 4.55 (d, *J* = 6.0 Hz, 2H), 2.38 (s, 3H), 2.24 (s, 3H), 2.00 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.5, 164.4, 149.2, 139.9, 138.2, 131.4, 128.94, 128.92, 128.7, 128.2, 127.8, 121.5, 43.9, 21.6, 20.8, 17.1; HRMS (EI) calcd for $C_{20}H_{22}NO_3S$ $[M + H]^+$ 356.1320, found 356.1327.

*(E)-3-(Benzylamino)-1-(4-chlorophenyl)-2-(thiomethyl)-3-oxo-prop-1-enyl Acetate (**2m**):* 162 mg, yield 86%, white solid, mp 148−151 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.5 Hz, 2H), 7.34, 7.28 (m, 6:1H), 6.72 (br s, 1H), 4.51 (d, *J* = 6.1 Hz, 2H), 2.21 (s, 3H), 1.97 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.3, 163.9, 147.3, 138.1, 135.5, 132.6, 130.1, 128.9, 128.5, 128.2, 127.8, 122.9, 43.9, 20.7, 16.9; HRMS (EI) calcd for $C_{19}H_{19}NO_3SCl$ $[M + H]^+$ 376.0774, found 376.0765.

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*(E)-3-(Ethylamino)-1-(3-fluorophenyl)-2-(thiomethyl)-3-oxoprop-1-enyl Acetate (**2n**):* 103 mg, yield 69%, white solid, mp 93−96 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32, 7.25, 7.03 (m each, 2:1:1H), 6.37 (br s, 1H), 3.36 (m, 2H), 2.22 (s, 3H), 2.15 (s, 3H), 1.16 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.3, 163.7, 162.3 (d, J = 246.4 Hz), 145.8 (d, J = 2.5 Hz), 136.1 (d, J = 8.0 Hz), 129.8 (d, J = 8.3 Hz), 124.4 (d, J = 3.0 Hz), 116.4 (d, J = 21.2 Hz), 115.6 (d, J = 23.1 Hz), 123.7, 34.7, 20.8, 16.6, 14.9; HRMS (EI) calcd for $C_{14}H_{16}NO_3SFNa$ [M + Na]$^+$ 320.0733, found 320.0731.

*N-Acetyl-N-ethyl-3-(3-fluorophenyl)-2-(thiomethyl)-3-oxopropanamide (**2n′**):* 82 mg, yield 92%, white solid, mp 60−63 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, J = 7.7 Hz, 1H), 7.68 (d, J = 9.5 Hz, 1H), 7.44 (dd, J = 13.6, 7.9 Hz, 1H), 7.24 (m, 1H), 5.91 (s, 1H), 3.81 (q, J = 7.1 Hz, 2H), 2.24 2.07 (s each, 3:3H), 1.25 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 188.2 (d, J = 2.2 Hz), 173.4, 168.9, 162.8 (d, J = 247.4 Hz), 137.6 (d, J = 6.5 Hz), 130.3 (d, J = 7.7 Hz), 124.6 (d, J = 3.0 Hz), 120.1 (d, J = 21.4 Hz), 115.6 (d, J = 22.7 Hz), 56.8, 41.1, 24.8, 14.0, 13.9; HRMS (EI) calcd for $C_{14}H_{16}NO_3SFNa$ [M + Na]$^+$ 320.0733, found 320.0722.

*(E)-3-(Benzylamino)-2-(thiomethyl)-1-(naphthalen-2-yl)-3-oxoprop-1-enyl Acetate (**2o**):* 156 mg, yield 80%, white solid, mp 125 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (s, 1H), 7.84 (t, J = 7.5 Hz, 3H), 7.67 (dd, J = 8.6, 1.5 Hz, 1H), 7.51, 7.33 (m each, 2:5H), 6.81 (br s, 1H), 4.56 (d, J = 6.0 Hz, 2H), 2.24 (s, 3H), 2.02 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.5, 164.2, 148.8, 138.2, 133.7, 132.7, 131.6, 128.9, 128.8, 128.6, 128.2, 127.9, 127.8, 127.3, 126.6, 125.7, 122.5, 43.9, 20.8, 17.0; HRMS (EI) calcd for $C_{23}H_{22}NO_3S$ [M + H]$^+$ 392.1320, found 392.1317.

*N-Acetyl-N-benzyl-2-(thiomethyl)-3-(naphthalen-2-yl)-3-oxopropanamide (**2o′**):* 10 mg, yield 5%, white solid, mp 109−112 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.63 (s, 1H), 8.08 (dd, J = 8.6, 1.6 Hz, 1H), 7.98, 7.89 (d each, J = 8.1 Hz, 1:1H), 7.93 (d, J = 8.7 Hz, 1H), 7.58, 7.38 (m each, 2:2H), 7.31 (s, 1H), 7.29 (d, J = 2.1 Hz, 2H), 6.26 (s, 1H), 5.28, 4.94 (d each, J = 16.8 Hz, 1:1H), 2.18 (s, 3H), 2.16 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 189.9, 174.1, 170.2, 136.4, 135.8, 132.8, 132.7, 130.7, 129.9, 129.2, 128.6, 128.5, 127.9, 127.7, 126.8, 126.3, 124.6, 56.9, 48.6, 25.4, 14.1; HRMS (EI) calcd for $C_{23}H_{22}NO_3S$ [M + H]$^+$ 392.1320, found 392.1315.

*(E)-3-(Ethylamino)-2-(thiomethyl)-3-oxo-1-(4-(trifluoromethyl)-phenyl)prop-1-enyl Acetate (**2p**):* 95 mg, yield 55%, white solid, mp 101−103 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65, 7.60 (d each, J = 8.5 Hz, 2:2H), 6.38 (br s, 1H), 3.37 (m, 2H), 2.23 (s, 3H), 2.15 (s, 3H), 1.17 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.3, 163.5, 145.9, 137.7, 131.1 (q, J = 32.6 Hz), 129.0, 125.2 (q, J = 3.8 Hz), 124.4, 123.8 (q, J = 270.6 Hz), 34.7, 20.8, 16.5, 14.9; HRMS (EI) calcd for $C_{15}H_{17}NO_3SF_3$ [M + H]$^+$ 348.0881, found 348.0876.

*1-(Ethylamino)-2-(thiomethyl)-1,3-dioxo-3-(4-(trifluoromethyl)-phenyl)propan-2-yl Acetate (**2p″**):* 33 mg, yield 18%, white solid, mp 133−136 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15, 7.67 (d each, J = 8.2 Hz, 2:2H), 7.37 (br s, 1H), 3.38 (m, 2H), 2.28 (s, 3H), 2.02 (s, 3H), 1.19 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 193.1, 169.9, 163.5, 137.6, 134.5 (q, J = 32.9 Hz), 129.6, 125.4 (q, J = 3.7 Hz), 124.9, 122.2 (q, J = 271.1 Hz), 88.8, 35.4, 20.8, 14.8, 13.0; HRMS (EI) calcd for $C_{15}H_{16}NO_4SF_3Na$ [M + Na]$^+$ 386.0650, found 386.0652.

*(E)-3-(Ethylamino)-1-(furan-2-yl)-2-(thiomethyl)-3-oxoprop-1-enyl Acetate (**2q**):* 102 mg, yield 76%, white solid, mp 91−94 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, J = 1.7 Hz, 1H, furyl CH), 6.93 (d, J = 3.5 Hz, 1H), 6.46 (dd, J = 3.5, 1.8 Hz, 1H), 6.29 (br s, 1H), 3.34 (m, 2H), 2.30 (s, 3H), 2.23 (s, 3H), 1.15 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.7, 163.3, 146.6, 137.3, 121.1, 143.2, 113.9, 111.9, 34.7, 20.7, 16.3, 15.0; HRMS (EI) calcd for $C_{12}H_{15}NO_4SNa$ [M + Na]$^+$ 292.0619, found 292.0613.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(thiophen-2-yl)prop-1-enyl Acetate (**2r**):* 118 mg, yield 68%, white solid, mp 90−93 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (dd, J = 3.8 1.2 Hz, 1H), 7.43 (dd, J = 5.1, 1.2 Hz, 1H), 7.35, 7.29 (m each, 4:1H), 7.03 (dd, J = 5.1, 3.9 Hz, 1H), 6.90 (br, J = 5.0 Hz, 1H), 4.51 (d, J = 6.0 Hz, 2H), 2.31 (s, 3H), 2.12 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.2, 164.0, 145.2, 138.2, 136.0, 130.4, 129.9, 128.9, 128.1, 127.7, 126.9, 118.7, 43.9, 20.8, 17.4; HRMS (EI) calcd for $C_{17}H_{18}NO_3S_2$ [M + H]$^+$ 348.0728, found 348.0732.

*(E)-3-(Ethylamino)-2-(thioethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2s**):* 117 mg, yield 80%, white solid, mp 74−76 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54, 7.36 (m each, 2:3H), 6.44 (br s, 1H), 3.37 (m, 2H), 2.66 (q, J = 7.4 Hz, 2H), 2.17 (s, 3H), 1.23 (t, J = 7.4 Hz, 3H), 1.19 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.3, 164.6, 149.8, 134.4, 129.5, 129.0, 128.1, 121.1, 34.7, 28.2, 21.0, 14.9, 14.7; HRMS (EI) calcd for $C_{15}H_{20}NO_3S$ [M + H]$^+$ 294.1164, found 294.1163.

*(E)-2-(Thioethyl)-3-oxo-1-phenyl-3-(1-phenylethylamino)prop-1-enyl Acetate (**2t**):* 155 mg, yield 84%, white solid, mp 113−115 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54, 7.36, 7.28 (m each, 2:7:1H), 6.63 (d, J = 8.1 Hz, 1H), 5.23 (p, J = 7.1 Hz, 1H), 2.63 (q, 2H), 1.98 (s, 3H), 1.54 (d, J = 6.9 Hz, 3H), 1.20 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.4, 163.7, 149.2, 142.9, 134.2, 129.5, 128.9, 128.8, 128.1, 127.6, 126.4, 121.2, 49.0, 28.0, 21.7, 20.8, 14.7; HRMS (EI) calcd for $C_{21}H_{24}NO_3S$ [M + H]$^+$ 370.1477, found 370.1471.

*(E)-2-(Benzylthio)-3-(ethylamino)-3-oxo-1-phenylprop-1-enyl Acetate (**2u**):* 94 mg, yield 53%, colorless liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28, 7.23 (m each, 7:3H), 6.33 (br s, 1H), 3.82 (s, 2H, SCH_2), 3.29 (m, 2H), 2.14 (s, 3H), 1.13 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.1, 164.6, 152.1, 137.0, 134.4, 129.5, 129.2, 128.9, 128.7, 128.0, 127.5, 120.3, 38.9, 34.7, 21.0, 14.9; HRMS (EI) calcd for $C_{20}H_{22}NO_3S$ [M + H]$^+$ 356.1320, found 356.1319.

*2-(Thiobenzyl)-1-(ethylamino)-1,3-dioxo-3-phenylpropan-2-yl Acetate (**2u″**):* 61 mg, yield 33%, white solid, mp 152−154 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (d, J = 7.3 Hz, 2H), 7.52, 7.37, 7.26, 7.32 (m each, 1:4:1:2H), 7.41 (br s, 1H), 4.09, 3.95 (d each, J = 12.9 Hz, 1:1H), 3.34 (m, 2H), 1.85 (s, 3H), 1.18 (t, J = 7.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 193.8, 169.7, 164.1, 136.4, 134.6, 133.4, 129.4, 129.3, 128.8, 128.4, 127.6, 89.7, 35.3, 35.1, 20.7, 14.7; HRMS (EI) calcd for $C_{20}H_{21}NO_4SNa$ [M + Na]$^+$ 394.1089, found 394.1085.

*(1E,3E)-5-(Benzylamino)-4-(thiomethyl)-5-oxo-1-p-tolylpenta-1,3-dien-3-yl Acetate (**2v**):* 156 mg, yield 82%, white solid, mp 116−118 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49, 6.84 (d each, J = 15.9 Hz, 1:1H), 7.39, 7.16 (d, J = 8.0 Hz, 2:2H), 7.30 (m, 5H), 7.11 (t, 1H), 4.51 (d, J = 5.9 Hz, 2H), 2.36 (s, 3H), 2.26 (s, 3H), 2.23 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.9, 163.9, 152.1, 139.5, 138.2, 133.1, 135.2, 119.6, 129.6, 128.8, 128.0, 127.7, 127.6, 120.1, 43.9, 21.5, 20.9, 18.0; HRMS (EI) calcd for $C_{22}H_{24}NO_3S$ [M + H]$^+$ 382.1477, found 382.1482.

*(1E,3E)-5-(Benzylamino)-1-(4-methoxyphenyl)-4-(thiomethyl)-5-oxopenta-1,3-dien-3-yl Acetate (**2w**):* 153 mg, yield 77%, white solid, mp 130−131 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (m, 3H), 7.31 (m, 5H), 7.12 (br s, 1H), 6.88 (d, J = 8.5 Hz, 2H), 6.82 (d, J = 15.8 Hz, 1H), 4.51 (d, J = 5.9 Hz, 2H), 3.82 (s, 3H), 2.25 (d, J = 7.9 Hz, 3:3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.9, 164.0, 160.7, 152.7, 138.3, 128.7, 135.0, 118.6, 129.2, 128.9, 128.0, 127.7, 114.4, 119.2, 55.5, 44.0, 21.0, 18.2; HRMS (EI) calcd for $C_{22}H_{24}NO_4S$ [M + H]$^+$ 398.1426, found 398.1424.

*(1E,3E)-5-(Benzylamino)-4-(thiomethyl)-5-oxo-1-(thiophen-2-yl)-penta-1,3-dien-3-yl Acetate (**2x**):* 142 mg, yield 76%, yellow solid, mp 113−115 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (d, J = 3.3 Hz, 1H), 7.30 (m, 6H), 7.13 (d, J = 3.3 Hz, 2H), 6.99 (m, 2H), 4.49 (d, J = 5.9 Hz, 2H), 2.24 (s, 3H), 2.22 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.7, 163.7, 151.5, 141.3, 138.2, 128.8, 119.9, 128.7, 128.0, 127.9, 127.8, 127.6, 127.1, 120.1, 43.8, 20.9, 18.0; HRMS (EI) calcd for $C_{19}H_{20}NO_3S_2$ [M + H]$^+$ 374.0885, found 374.0883.

*(E)-4-(Benzylamino)-3-(thiomethyl)-4-oxobut-2-en-2-yl Acetate (**2y**):* 92 mg, yield 66%, white solid, mp 62−65 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (m, 5H), 6.78 (br s, 1H), 4.47 (d, J = 6.0 Hz, 2H), 2.21 (s, 3H), 2.19 (s, 3H), 2.03 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.0, 164.0, 153.7, 138.3, 128.9, 128.0, 127.7, 119.9, 43.8, 20.9, 19.6, 17.3; HRMS (EI) calcd for $C_{14}H_{18}NO_3S$ [M + H]$^+$ 280.1007, found 280.1002.

*(E)-3-(Thiomethyl)-4-oxo-4-(4-(trifluoromethyl)benzylamino)but-2-en-2-yl Acetate (**2z**):* 109 mg, yield 63%, white solid, mp 68−70 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58, 7.41 (d each, J = 8.1 Hz, 2:2H),

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J. Org. Chem. 2018, 83, 5731−5750

6.96 (br s, 1H), 4.52 (d, J = 6.2 Hz, 2H), 2.21, 2.20, 2.05 (s each, 3:3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.9, 164.2, 154.7, 142.4, 130.0 (q, J = 32.4 Hz), 128.1, 125.8 (q, J = 3.7 Hz), 124.2 (q, J = 271.9 Hz), 119.4, 43.2, 20.9, 19.7, 17.5; HRMS (EI) calcd for $C_{15}H_{17}NO_3SF_3$ $[M + H]^+$ 348.0881, found 348.0881.

*(E)-3-(Thiomethyl)-4-oxo-4-(1-phenylethylamino)but-2-en-2-yl Acetate (**2z1**):* 108 mg, yield 74%, white solid, mp 77−79 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.32, 7.25 (m each, 4:1H), 6.60 (d, J = 7.7 Hz, 1H), 5.16 (m, 1H), 2.17, 2.14 (s each, 3:3H), 1.99 (s, 3H), 1.49 (d, J = 6.9 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.0, 163.1, 152.1, 143.0, 128.8, 127.5, 126.3, 120.4, 48.8, 21.8, 20.8, 19.1, 16.9; HRMS (EI) calcd for $C_{15}H_{20}NO_3S$ $[M + H]^+$ 294.1164, found 294.1165.

*(E)-3-(Diethylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2z2**):* 121 mg, yield 79%, white solid, mp 62−65 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.55, 7.36 (m each, 2:3H), 3.57, 3.37 (m each, 2:2H), 2.21 (s, 3H), 2.10 (s, 3H), 1.24, 1.19 (t each, J = 7.1 Hz, 3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.8, 163.9, 142.8, 133.7, 129.2, 128.3, 128.2, 122.1, 42.9, 38.6, 20.7, 15.9, 13.8, 12.9; HRMS (EI) calcd for $C_{16}H_{22}NO_3S$ $[M + H]^+$ 308.1320, found 308.1319.

*(E)-3-(Diethylamino)-2-(thiomethyl)-3-oxo-1-p-tolylprop-1-enyl Acetate (**2z3**):* 116 mg, yield 72%, white solid, mp 54−57 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.43, 7.18 (d each, J = 8.1 Hz, 2:2H), 3.64, 3.32 (m each, 2:2H), 2.34 (s, 3H), 2.20 (s, 3H), 2.09 (s, 3H), 1.23, 1.18 (m each, 3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.8, 164.0, 143.1, 139.3, 130.8, 128.9, 128.2, 121.3, 42.9, 38.5, 21.5, 20.7, 16.0, 13.8 12.9; HRMS (EI) calcd for $C_{17}H_{24}NO_3S$ $[M + H]^+$ 322.1477, found 322.1472.

*(E)-1-(4-Chlorophenyl)-3-(diethylamino)-2-(thiomethyl)-3-oxoprop-1-enyl Acetate (**2z4**):* 121 mg, yield 71%, white solid, mp 79−80 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.47, 7.32 (d each, J = 8.7 Hz, 2:2H), 3.60, 3.31 (m each, 2:2H), 2.20 (s, 3H), 2.08 (s, 3H), 1.21, 1.16 (t each, 3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 163.5, 141.5, 134.9, 132.1, 129.6, 128.4, 122.9, 42.8, 38.6, 20.6, 15.8, 13.7, 12.8; HRMS (EI) calcd for $C_{16}H_{21}NO_3SCl$ $[M + H]^+$ 342.0931, found 342.0931.

*(1E,3E)-5-(3,5-Dichlorophenylamino)-4-(thioethyl)-1-(furan-2-yl)-5-oxopenta-1,3-dien-3-yl Acetate (**2z5**):* 113 mg, yield 53%, brown solid, mp 121−124 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 8.93 (br s, 1H), 7.52 (m, 4H, 1H), 7.10 (t, 1H), 6.76 (d, J = 15.6 Hz, 1H), 6.53 (d, J = 3.3 Hz, 1H), 6.46 (dd, J = 3.3, 1.8 Hz, 1H), 2.75 (q, J = 7.4 Hz, 2H), 2.36 (s, 3H), 1.33 (t, J = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 162.5, 156.6, 152.2, 139.8, 144.5, 135.4, 124.4, 123.8, 119.3, 118.1, 113.6, 112.6, 116.6, 30.2, 21.2, 14.7; HRMS (EI) calcd for $C_{19}H_{18}NO_4SCl_2$ $[M + H]^+$ 426.0334, found 426.0330.

*(E)-3-((Z)-3,7-Dimethylocta-2,6-dienylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2z6**):* 120 mg, yield 62%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.53 (dd, J = 7.4, 2.1 Hz, 2H), 7.36 (m, 3H), 6.34 (br s, 1H), 5.22, 5.07 (m each, 1:1H), 3.93 (t, J = 6.3 Hz, 2H), 2.21, 2.15 (s each, 3:3H), 2.08 (dd, J = 9.9, 5.0 Hz, 2H), 2.01 (m, 2H), 1.69, 1.67, 1.59 (s each, 3:3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.3, 163.9, 148.1, 140.5, 134.2, 131.9, 129.5, 128.6, 128.1, 123.8, 119.5, 122.3, 39.6, 37.7, 26.4, 25.7, 20.9, 17.8, 16.8, 16.4; HRMS (EI) calcd for $C_{22}H_{30}NO_3S$ $[M + H]^+$ 388.1946, found 388.1944.

*(1E,1′E)-3,3′-(Octane-1,8-diylbis(azanediyl))bis(2-(thiomethyl)-3-oxo-1-phenylprop-1-ene-3,1-diyl) Diacetate (**2z7**):* 217 mg, yield 71%, white solid, mp 127−130 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.54, 7.38 (m each, 4:6H), 6.42 (s, 2H), 3.33 (m, 4H), 2.22 (s, 6H), 2.16 (s, 6H), 1.54 (m, 4H), 1.35 (s, 8H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 164.2, 148.4, 134.3, 129.6, 128.8, 128.2, 122.5, 39.9, 29.8, 29.3, 27.05, 21.1, 17.0; HRMS (EI) calcd for $C_{32}H_{41}N_2O_6S_2$ $[M + H]^+$ 613.2406, found 613.2405.

*(S,E)-Methyl 2-(3-acetoxy-2-(thiomethyl)-3-phenylacrylamido)-propanoate (**2z8**):* 86 mg, yield 51%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.53, 7.37 (m each, 2:3H), 6.94 (d, J = 7.5 Hz, 1H), 4.63 (p, J = 7.3 Hz, 1H), 3.73 (s, 3H), 2.23, 2.15 (s each, 3:3H), 1.43 (d, J = 7.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 173.0, 169.3, 163.8, 149.5, 134.3, 129.7, 128.8, 128.2, 121.7, 52.6, 48.3, 21.0 18.3, 17.0; HRMS (EI) calcd for $C_{16}H_{20}NO_5S$ $[M + H]^+$ 338.1062, found 338.1064.

*(R,E)-1-(4-Chlorophenyl)-2-(thiomethyl)-3-oxo-3-(1-phenylethylamino)prop-1-enyl Acetate (**2z9**):* 171 mg, yield 88%, white solid, mp 120−122 °C, 99% ee, $[\alpha]_D^{20}$ −7.50 (c 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.47, 7.33 (d each, J = 8.6 Hz, 2:2H), 7.36 (d, J = 4.3 Hz, 4H), 7.28 (m, 1H), 6.55 (d, J = 8.3 Hz, 1H), 5.23 (m, 1H), 2.19 (s, 3H), 1.95 (s, 3H), 1.54 (d, J = 6.9 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.4, 162.9, 146.0, 142.7, 135.4, 132.5, 130.0, 128.9, 128.5, 127.7, 126.4, 123.3, 49.0, 21.8, 20.7, 16.5; HRMS (EI) calcd for $C_{20}H_{21}NO_3SCl$ $[M + H]^+$ 390.0931, found 390.0930; HPLC (OG-H column, iPrOH/hexane 2:98, 0.7 mL/min, 254 nm) t_1 = 34.3 min (major), t_2 = 41.3 min.

*(S,E)-2-(Thiomethyl)-3-oxo-3-(1-phenylethylamino)-1-(thiophen-2-yl)prop-1-enyl Acetate (**2z10**):* 132 mg, yield 73%, white solid, mp 89−92 °C, 99% ee, $[\alpha]_D^{20}$ +10.10 (c 1.01, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.4 (dt, J = 5.2, 1.2 Hz, 2H), 7.38 (d, J = 4.4 Hz, 4H), 7.31 (dq, J = 8.7, 4.4 Hz, 1H), 7.05 (dd, J = 5.1, 3.9 Hz, 1H), 6.74 (d, J = 8.2 Hz, 1H), 5.24 (dq, J = 14.0, 7.0 Hz, 1H), 2.31 (s, 3H), 2.12 (s, 3H), 1.55 (d, J = 6.9 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.3, 163.0, 143.6, 142.8, 136.0, 130.0, 129.4, 128.8, 127.6, 126.9, 126.3, 119.6, 49.1, 21.8, 20.7, 17.0; HRMS (EI) calcd for $C_{18}H_{20}NO_3S_2$ $[M + H]^+$ 362.0885, found 362.0882; HPLC (OG-H column, iPrOH/hexane 5:95, 0.9 mL/min, 254 nm) t_1 = 25.9 min, t_2 = 28.3 min (major).

*(1E,3E)-4-(Thiomethyl)-5-oxo-5-((S)-1-phenylethylamino)-1-o-tolylpenta-1,3-dien-3-yl Acetate (**2z11**):* 144 mg, yield 73%, yellow solid, mp 66−69 °C, 99% ee, $[\alpha]_D^{20}$ −3.20 (c 0.50, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.56, 7.20, 7.16 (m, 1:2:1H), 7.36 (m, 5H), 7.28 (dd, J = 8.8, 4.4 Hz, 1H), 7.06 (d, J = 15.8 Hz, 1H), 6.88 (d, J = 8.2 Hz, 1H), 5.22 (m, 1H), 2.35 (s, 3H), 2.25 (s, 3H), 2.19 (s, 3H), 1.54 (d, J = 6.9 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.9, 163.0, 150.3, 142.9, 136.5, 134.9, 132.1, 127.6, 130.7, 128.9, 128.8, 126.4, 126.3, 126.2, 121.4, 121.6, 49.0, 21.8, 20.8, 19.8, 17.5; HRMS (EI) calcd for $C_{23}H_{26}NO_3S$ $[M + H]^+$ 396.1633, found 396.1638; HPLC (OD-H column, iPrOH/hexane 30:70, 0.7 mL/min, 230 nm) t_1 = 5.6 min (major), t_2 = 7.9 min.

*(1E,3E)-1-(4-Chlorophenyl)-4-(thiomethyl)-5-oxo-5-((R)-1-phenylethylamino)penta-1,3-dien-3-yl Acetate (**2z12**):* 156 mg, yield 75%, yellow solid, mp 124−126 °C, 99% ee, $[\alpha]_D^{20}$ +24.6 (c 0.50, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.34, 6.64 (d, J = 15.9 Hz, 1:1H), 7.31 (d, J = 6.5 Hz, 2H), 7.26, 7.19 (m, 4:1H), 7.22 (d, J = 8.5 Hz, 2H), 6.76 (d, J = 8.3 Hz, 1H), 5.12 (m, 1H), 2.16 (s, 3H), 2.09 (s, 3H), 1.45 (d, J = 6.9 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.0, 162.9, 149.8, 142.9, 134.8, 134.5, 132.9, 127.3, 129.1, 128.9, 128.7, 126.4, 120.9, 122.3, 49.0, 21.8, 20.9, 17.5; HRMS (EI) calcd for $C_{22}H_{23}NO_3SCl$ $[M + H]^+$ 416.1087, found 416.1087; HPLC (OG-H column, iPrOH/hexane 20:80, 0.7 mL/min, 254 nm) t_1 = 11.3 min (major), t_2 = 14.3 min.

*(E)-3-(((1R,4aS,10aR)-7-Isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Acetate (**2z13**):* 202 mg, yield 78%, colorless liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.56 (dd, J = 6.5, 3.0 Hz, 2H), 7.39, 7.01 (m each, 3:1H), 6.93 (s, 1H), 7.19 (d, J = 8.2 Hz, 1H), 6.50 (m, 1H), 3.31 (m, 2H), 2.95 (dd, J = 9.5, 6.9 Hz, 2H), 2.85 (dt, J = 13.8, 6.9 Hz, 1H), 2.34 (d, J = 12.8 Hz, 1H), 2.20 (s, 3H), 2.01 (d, J = 1.2 Hz, 1H), 1.98 (s, 3H), 1.82 (dd, J = 11.6, 8.6 Hz, 2H), 1.74 (m, 2H), 1.51 (dt, J = 10.4, 7.8 Hz, 2H), 1.45 (d, J = 10.0 Hz, 2H), 1.37 (m, 2H), 1.29 (d, J = 10.7 Hz, 2H), 1.27 (s, 3H), 1.25 (d, J = 3.9 Hz, 3H), 1.22 (d, J = 11.2 Hz, 3H), 1.01 (d, J = 3.0 Hz, 3H), 0.98 (m, 1H), 0.91 (m, 2H), 0.85 (m, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.3, 164.5, 148.5, 147.0, 145.7, 134.8, 134.2, 129.5, 128.7, 128.0, 126.9, 124.2, 123.9, 122.3, 50.6, 45.7, 38.4, 37.5, 37.4, 36.2, 33.5, 30.1, 25.3, 24.04, 24.02, 20.7, 19.1, 18.6, 26.9 17.1; HRMS (EI) calcd for $C_{32}H_{42}NO_3S$ $[M + H]^+$ 520.2885, found 520.2882.

*(E)-3-(Allylamino)-2-(thiomethyl)-3-oxo-1-phenylprop-1-enyl Pivalate (**2z14**):* 103 mg, yield 62%, white solid, mp 131−132 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.52, 7.36 (m each, 2:3H), 6.30 (s, 1H), 5.85 (m, 1H), 5.23 (d, J = 17.2 Hz, 1H), 5.16 (d, J = 10.2 Hz, 1H), 3.94 (td, J = 5.7, 1.3 Hz, 2H), 2.23 (s, 3H), 1.22 (s, 9H); $^{13}C\{^1H\}$

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J. Org. Chem. 2018, 83, 5731−5750

NMR (100 MHz, $CDCl_3$) δ 176.9, 164.2, 147.3, 133.9, 133.7, 117.1, 129.5, 128.6, 128.1, 122.2, 42.2, 38.9, 26.9, 16.7; HRMS (EI) calcd for $C_{18}H_{24}NO_3S$ $[M + H]^+$ 334.1477, found 334.1476.

*(E)-3-(Benzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3a**):* 186 mg, yield 77%, white solid, mp 100−101 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.47 (br s, 1H), 7.25 (m, 5H), 5.15 (s, 1H), 4.47 (d, J = 5.9 Hz, 2H), 2.35 (s, 3H), 1.64 (m, 1H), 0.95, 0.70 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.3, 167.1, 137.6, 128.8, 127.6, 127.5, 89.7, 47.8, 20.2, 14.46, 8.91; HRMS (EI) calcd for $C_{14}H_{17}NOS$ $[M + H]^+$ 248.1109, found 248.1108.

*(E)-3-(2-Methylbenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3b**):* 254 mg, yield 80%, white solid, mp 114−115 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.48 (br s, 1H), 7.34, 7.20 (m each, 1:3H), 5.25 (s, 1H), 4.52 (d, J = 5.7 Hz, 2H), 2.42 (s, 3H), 2.38 (s, 3H), 1.73 (m, 1H), 1.03, 0.80 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.8, 166.7, 135.9, 135.1, 130.4, 127.9, 127.6, 126.1, 89.3, 45.7, 19.9, 18.9, 14.1, 8.7; HRMS (EI) calcd for $C_{15}H_{19}NOS$ $[M + H]^+$ 262.1266, found 262.1266.

*(E)-3-(3-Methylbenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3c**):* 210 mg, yield 80%, white solid, mp 111−112 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.49 (br s, 1H), 7.21, 7.12 (m each, 1:3H), 5.18 (s, 1H), 4.45 (d, J = 5.8 Hz, 2H), 2.33 (s, 3H), 2.32 (s, 3H), 1.68 (m, 1H), 1.00, 0.72 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.8, 166.8, 138.2, 137.2, 128.5, 128.2, 127.9, 124.3, 89.3, 47.5, 21.3, 19.9, 14.1, 8.7; HRMS (EI) calcd for $C_{15}H_{19}NOS$ $[M + H]^+$ 262.1266, found 262.1266.

*(E)-3-(4-Methylbenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3d**):* 205 mg, yield 78%, white solid, mp 118−119 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.50 (br s, 1H), 7.17, 7.12 (d each, J = 8.0 Hz, 2:2H), 5.18 (s, 1H), 4.44 (d, J = 5.9 Hz, 2H), 2.34 (s, 3H), 2.31 (s, 3H), 1.70 (m, 1H), 1.00, 0.72 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.7, 166.7, 136.9, 134.2, 129.2, 127.1, 89.3, 47.3, 20.9, 19.9, 14.1, 8.6; HRMS (EI) calcd for $C_{15}H_{19}NOS$ $[M + H]^+$ 262.1266, found 262.1266.

*(E)-3-(2-Methoxylbenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3e**):* 270 mg, yield 80%, white solid, mp 115−116 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.42 (br s, 1H), 7.24, 6.90 (m each, 2:1H), 6.82 (d, J = 8.1 Hz, 1H), 5.15 (s, 1H), 4.49 (d, J = 6.2 Hz, 2H), 3.80 (s, 3H), 2.32 (s, 3H), 1.65 (m, 1H), 0.97, 0.71 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.5, 166.8, 156.9, 125.4, 128.6, 128.2, 120.3, 110.1, 89.1, 55.2, 42.8, 19.9, 14.1, 8.5; HRMS (EI) calcd for $C_{15}H_{19}NO_2S$ $[M + H]^+$ 278.1215, found 278.1217.

*(E)-3-(2-Fluorobenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3f**):* 206 mg, yield 80%, white solid, mp 121−122 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.47 (br s, 1H), 7.29, 7.21, 7.08, 7.01 (m, 1:1:1:1H), 5.17 (s, 1H), 4.53 (d, J = 6.1 Hz, 2H), 2.35 (s, 3H), 1.63 (m, 1H), 1.00, 0.71 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.2, 166.6, 160.4 (d, J = 246.7 Hz), 115.3 (d, J = 21.1 Hz), 129.2 (d, J = 8.1 Hz), 129.1 (d, J = 4.0 Hz), 124.5 (d, J = 14.6 Hz), 124.3 (d, J = 3.6 Hz), 89.8, 41.2 (d, J = 4.7 Hz), 20.1, 14.2, 8.8; HRMS (EI) calcd for $C_{14}H_{16}FNOS$ $[M + H]^+$ 266.1015, found 266.1014.

*(E)-3-(2-Bromobenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3g**):* 251 mg, yield 77%, white solid, mp 128−129 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.47 (br s, 1H), 7.46 (d, J = 7.9 Hz, 1H), 7.28 (m, 2H), 7.06 (t, 1H), 5.14 (s, 1H), 4.50 (d, J = 6.3 Hz, 2H), 2.30 (s, 3H), 1.63 (m, 1H), 0.92, 0.68 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.5, 167.1, 136.7, 123.1, 132.9, 129.1, 128.9, 127.8, 90.0, 47.9, 20.2, 14.4, 9.0; HRMS (EI) calcd for $C_{14}H_{16}BrNOS$ $[M + H]^+$ 326.0214, found 326.0212.

*(E)-3-(3-Bromobenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3h**):* 509 mg, yield 78%, white solid, mp 126−127 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.49 (br s, 1H), 7.40, 7.37, 7.17 (m each, 1:1:2H), 5.18 (s, 1H), 4.44 (d, J = 6.2 Hz, 2H), 2.35 (s, 3H), 1.62 (m, 1H), 0.89, 0.73 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.4, 166.8, 139.9, 122.7, 130.6, 130.3, 130.2, 125.8, 89.9, 46.9, 20.2, 14.3, 8.9; HRMS (EI) calcd for $C_{14}H_{16}BrNOS$ $[M + H]^+$ 326.0214, found 326.0218.

*(E)-3-(4-Bromobenzylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3i**):* 515 mg, yield 79%, white solid, mp 128−129 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.50 (br s, 1H), 7.42, 7.14 (d each, J = 8.3 Hz, 2:2H), 5.18 (s, 1H), 4.42 (d, J = 6.1 Hz, 2H), 2.36 (s, 3H), 1.65 (m, 1H), 0.95, 0.73 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.4, 166.8, 136.6, 121.4, 131.8, 128.9, 89.9, 46.9, 20.1, 14.3, 8.9; HRMS (EI) calcd for $C_{14}H_{16}BrNOS$ $[M + H]^+$ 326.0214, found 326.0216.

*(E)-3-(Benzylethylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3j**):* 217 mg, yield 83%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.26 (br s, 1H), 7.25, 7.18 (m each, 2:2H), 5.10 (s, 1H), 3.47 (m, 2H), 2.87 (m, 2H), 2.31 (s, 3H), 1.62 (m, 1H), 0.96, 0.71 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.7, 166.7, 138.23, 128.6, 128.5, 126.5, 88.9, 45.5, 36.2, 19.9, 14.0, 8.6; HRMS (EI) calcd for $C_{15}H_{19}NOS$ $[M + H]^+$ 262.1266, found 262.1265.

*(E)-3-(Vinylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3k**):* 310 mg, yield 78%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.16 (br s, 1H), 5.77, 5.17, 5.07 (m, 1:1:1H), 5.06 (s, 1H), 3.83 (m, 2H), 2.29 (s, 3H), 1.57 (m, 1H), 0.87, 0.63 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.7, 166.7, 133.0, 116.7, 89.2, 45.8, 19.9, 14.1, 8.6; HRMS (EI) calcd for $C_{10}H_{15}NOS$ $[M + H]^+$ 198.0953, found 198.0952.

*(E)-3-(Isobutylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3l**):* 149 mg, yield 70%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.14 (br s, 1H), 4.94 (s, 1H), 2.93 (t, 2H), 2.20 (s, 3H), 1.70 (m, 1H) 1.47 (m, 1H), 0.80 (d, J = 6.8 Hz, 3:3H), 0.78, 0.53 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.0, 166.8, 88.3, 51.0, 28.4, 19.8, 19.6, 13.7, 8.2; HRMS (EI) calcd for $C_{11}H_{19}NOS$ $[M + H]^+$ 214.1266, found 214.1264.

*(E)-1-Cyclopropyl-3-(cyclopropylamino)-3-(methylthio)prop-2-en-1-one (**3m**):* 310 mg, yield 79%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 10.96 (br s, 1H), 5.03 (s, 1H), 2.50 (m, 1H), 2.28 (s, 3H), 1.56 (m, 1H), 0.84, 0.61 (m each, 2:6H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.7, 169.2, 88.9, 24.9, 19.9, 14.1, 8.6, 7.9; HRMS (EI) calcd for $C_{10}H_{15}NOS$ $[M + H]^+$ 198.0953, found 198.0952.

*(E)-3-(Cyclohexylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3n**):* 250 mg, yield 85%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.14 (br s, 1H), 4.94 (s, 1H), 3.36 (m, 1H, *CH*), 2.22 (s, 3H), 1.78, 1.58, 1.53, 1.41, 1.15 (m each, 2:2:1:5H), 1.46 (m, 1H), 0.80, 0.55 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.9, 165.2, 88.2, 52.3, 32.9, 25.1, 24.1, 19.6, 13.8, 8.2; HRMS (EI) calcd for $C_{13}H_{21}NOS$ $[M + H]^+$ 240.1422, found 240.1422.

*(E)-3-(Cycloheptylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3o**):* 210 mg, yield 83%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.21 (br s, 1H), 4.95 (s, 1H), 3.57 (m, 1H), 2.25 (s, 3H), 1.86 (m, 2H), 1.54 (m, 11H), 0.87, 0.56 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.8, 165.2, 88.2, 54.6, 35.1, 27.8, 23.7, 19.7, 13.9, 8.2; HRMS (EI) calcd for $C_{14}H_{23}NOS$ $[M + H]^+$ 254.1579, found 254.1579.

*(E)-3-(Tetrahydrofuran-2-ylmethylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3p**):* 401 mg, yield 83%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.10 (br s, 1H), 4.97 (s, 1H), 3.88 (m, 1H), 3.73, 3.59 (m each, 1:1H), 3.21 (m, 2H), 2.22 (s, 3H), 1.84 (m, 1H), 1.73, 1.46 (m each, 2:2H), 0.80, 0.54 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.7, 166.7, 89.2, 77.1, 68.3, 28.9, 25.6, 47.7, 19.9, 14.2, 8.6; HRMS (EI) calcd for $C_{12}H_{19}NO_2S$ $[M + H]^+$ 242.1215, found 242.1214.

*(E)-Ethyl-2-((3-cyclopropyl-1-(methylthio)-3-oxoprop-1-en-1-yl)-amino)acetate (**3q**):* 140 mg, yield 63%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.31 (s, 1H), 5.18 (s, 1H), 4.19 (m, 2H), 4.03 (m, 2H), 2.37 (s, 3H), 1.65 (m, 1H), 1.24 (m, 3H), 0.96, 0.70 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.8, 168.8, 165.9, 90.7, 61.6, 45.3, 20.3, 14.5, 14.2, 9.1; HRMS (EI) calcd for $C_{11}H_{17}NO_3S$ $[M + H]^+$ 244.1007, found 244.1005.

*(E)-Methyl-2-((3-cyclopropyl-1-(methylthio)-3-oxoprop-1-en-1-yl)amino)-2-phenylacetate (**3r**):* 198 mg, yield 65%, yellow solid, mp 108−109 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.97 (d, J = 7.5 Hz, 1H), 7.40, 7.32 (m each, 2:3H), 5.35 (d, J = 7.5 Hz, 1H), 5.20 (s, 1H), 3.70 (s, 3H), 2.32 (s, 3H), 1.69 (m, 1H), 1.06, 0.73 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.9, 170.2, 164.8, 136.5, 129.0, 128.6, 127.2, 91.3, 60.8, 53.0, 20.4, 14.6, 9.2, 9.1; HRMS (EI) calcd for $C_{16}H_{19}NO_3S$ $[M + H]^+$ 306.1164, found 306.1166.

*(E)-3-(Phenylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3s**):* 222 mg, yield 45%, yellow solid, mp 89−90 °C; ^1H NMR

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J. Org. Chem. 2018, 83, 5731−5750

(400 MHz, $CDCl_3$) δ 12.95 (br s, 1H), 7.13, 7.01 (m each, 4:1H), 5.24 (s, 1H), 2.12 (s, 3H), 1.70 (m, 1H), 0.94, 0.72 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.1, 163.7, 137.7, 128.3, 125.1, 123.9, 91.2, 19.8, 13.8, 8.7; HRMS (EI) calcd for $C_{13}H_{15}NOS$ $[M + H]^+$ 234.0953, found 234.0954.

(E)-3-(p-Phenylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3t**): 332 mg, yield 67%, white solid, mp 98−99 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 12.80 (br s, 1H), 7.12, 7.06 (d each, J = 8.6 Hz, 2:2H), 5.33 (s, 1H), 2.30 (s, 6H), 1.79, 1.08, 0.78 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 194.6, 165.0, 135.8, 135.5, 129.4, 125.0, 91.1, 20.9, 20.3, 14.4, 9.1; HRMS (EI) calcd for $C_{14}H_{17}NOS$ $[M + H]^+$ 248.1109, found 248.1109.

(E)-3-(1-Phenylethylamino)-3-(thiomethyl)-1-cyclopropylprop-2-en-1-one (**3u**): 159 mg, yield 61%, white solid, mp 68−70 °C, 99% ee, $[\alpha]_D^{20}$ +668.21 (c 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 11.70 (br s, 1H), 7.49−7.17 (m, 5H), 5.17 (s, 1H), 4.83 (m, 1H), 2.31 (s, 3H), 1.71 (m, 1H), 1.57 (d, J = 6.8 Hz, 3H), 1.05, 0.77 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.9, 166.3, 143.6, 128.6, 127.2, 125.8, 89.4, 53.8, 24.5, 20.1, 14.4, 8.8; HRMS (EI) calcd for $C_{15}H_{20}NOS$ $[M + H]^+$ 262.1266, found 262.1263; HPLC (AD-H column, iPrOH/hexane 3:97, 0.7 mL/min, 254 nm) t_1 = 9.4 min (major), t_2 = 10.2 min.

(E)-1-Cyclopropyl-3-((((2R,4aS,10aS)-7-isopropyl-2,4a,10a-trimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-2-yl)methyl)amino)-3-(methylthio)prop-2-en-1-one (**3v**): 320 mg, yield 73%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 11.49 (br s, 1H), 7.19, 7.02 (d each, J = 8.1 Hz, 1:1H), 6.92 (s, 1H), 5.14 (s, 1H), 3.23 (m, 2H), 2.87 (m, 3H), 2.40 (s, 3H), 2.30 (d, J = 12.6 Hz, 1H), 1.82, 1.68, 1.45, 1.00, 0.74 (m each, 2:3:4:2:2H) 1.25, 1.24, 1.01 (6:3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 193.7, 167.4, 147.1, 145.6, 134.7, 126.9, 124.3, 123.9, 89.1, 55.9, 46.3, 38.2, 37.9, 37.6, 36.3, 33.5, 30.3, 26.9, 25.5, 24.1, 20.1, 19.4, 18.7, 18.2, 14.4, 8.8; HRMS (EI) calcd for $C_{27}H_{40}NOS$ $[M + H]^+$ 426.2831, found 426.2834.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3w**): 533 mg, yield 83%, white solid, mp 121−122 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.46 (br s, 1H), 7.28, 7.11, 7.05 (m each, 7:2:1H), 5.09 (s, 1H), 4.43 (d, J = 6.0 Hz, 2H), 2.40 (m, 1H), 2.27 (s, 3H), 1.85 (m, 1H), 1.57, 1.17 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.7, 167.4, 141.9, 137.4, 128.9, 128.4, 127.7, 127.4, 126.0, 125.9, 89.9, 47.8, 32.9, 26.9, 17.4, 14.4; HRMS (EI) calcd for $C_{20}H_{21}NOS$ $[M + H]^+$ 324.1422, found 324.1421.

(E)-3-(2-Bromobenzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3x**): 302 mg, yield 75%, white solid, mp 131−132 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.63 (t, 1H), 7.57 (d, J = 7.9 Hz, 1H), 7.41, 7.34, 7.22 (m each, 1:3:4H), 5.23 (s, 1H), 4.62 (d, J = 6.3 Hz, 2H), 2.56 (m, 1H), 2.36 (s, 3H), 2.03 (m, 1H), 1.76, 1.30 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.9, 167.4, 141.9, 136.6, 123.2, 132.9, 129.2, 128.9, 128.4, 127.8, 125.9, 90.4, 47.9, 32.9, 26.9, 17.5, 14.4; HRMS (EI) calcd for $C_{20}H_{20}B_rNOS$ $[M + H]^+$ 402.0527, found 402.0526.

(E)-3-(3-Bromobenzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3y**): 716 mg, yield 89%, white solid, mp 130−131 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.60 (t, 1H), 7.53, 7.33 (m each, 2:7H), 5.23 (s, 1H), 4.49 (d, J = 6.2 Hz, 2H), 2.59 (m, 1H), 2.36 (s, 3H), 2.06 (m, 1H), 1.71, 1.31 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.8, 167.3, 141.7, 139.8, 122.8, 130.7, 130.3, 130.2, 128.3, 128.2, 125.9, 90.3, 47.0, 32.8, 26.9, 17.5, 14.3; HRMS (EI) calcd for $C_{20}H_{20}B_rNOS$ $[M + H]^+$ 402.0527, found 402.0528.

(E)-3-(4-Bromobenzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z**): 699 mg, yield 87%, white solid, mp 129−130 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.59 (t, J = 5.6 Hz, 1H), 7.48, 7.13 (d each, J = 8.4 Hz, 2:2H), 7.29, 7.19 (m each, 2:3H), 5.21 (s, 1H), 4.47 (d, J = 6.1 Hz, 2H), 2.57 (m, 1H), 2.36 (s, 3H), 1.96 (m, 1H), 1.69, 1.29 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.9, 167.3, 141.8, 136.5, 121.5, 131.9, 129.1, 128.4, 125.9, 90.2, 47.1, 32.8, 26.9, 17.5, 14.3; HRMS (EI) calcd for $C_{20}H_{20}B_rNOS$ $[M + H]^+$ 402.0527, found 402.0528.

(E)-3-(3-Methylbenzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z1**): 598 mg, yield 89%, white solid, mp 124−126 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.62 (br s, 1H), 7.36−7.16 (m, 9H), 5.27 (s, 1H), 4.55 (d, J = 6.0 Hz, 2H), 2.58 (m, 1H), 2.42 (s, 3H), 2.40 (s, 3H), 2.00 (m, 1H), 1.76, 1.35 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.5, 167.3, 141.9, 138.4, 137.1, 128.6, 128.4, 128.3, 128.1, 125.9, 125.9, 124.4, 89.7, 47.7, 32.8, 26.7, 21.4, 17.3, 14.2; HRMS (EI) calcd for $C_{21}H_{23}NOS$ $[M + H]^+$ 338.1579, found 338.1574.

(E)-3-(4-Chlorobenzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z2**): 650 mg, yield 91%, white solid, mp 121−122 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.59 (br s, 1H), 7.36, 7.28, 7.20, 7.17 (m each, 2:4:1:2H), 5.22 (s, 1H), 4.51 (d, J = 6.1 Hz, 2H), 2.50 (m, 1H), 2.39 (s, 3H), 1.97, 1.72, 1.30 (m each, 1:1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.0, 167.4, 141.9, 136.0, 133.5, 129.0, 128.8, 128.4, 126.1, 90.3, 47.1, 32.9, 27.0, 17.5, 14.4; HRMS (EI) calcd for $C_{20}H_{20}ClNOS$ $[M + H]^+$ 358.1032, found 358.1029.

(E)-3-(4-Trifluorbenzylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z3**): 650 mg, yield 83%, white solid, mp 133−134 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.60 (br s, 1H), 7.57, 7.39 (d each, J = 8.0 Hz, 2:2H), 7.23 (d, J = 7.7 Hz, 2H), 7.15, 7.08 (m each, 1:2H), 5.18 (s, 1H), 4.55 (d, J = 6.1 Hz, 2H), 2.44 (m, 1H), 2.33 (s, 3H), 1.92 (m, 1H), 1.62, 1.23 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 192.3, 167.5, 141.9, 141.8 (q, J = 1.4 Hz), 129.9 (q, J = 32.5 Hz), 128.5, 127.6, 125.8 (q, J = 3.8 Hz), 124.2 (q, J = 272.0 Hz), 90.5, 47.3, 32.9, 27.2, 17.6, 14.4; HRMS (EI) calcd for $C_{21}H_{20}F_3NOS$ $[M + H]^+$ 392.1296, found 392.1292.

(E)-3-(Diphenylmethylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z4**): 573 mg, yield 71%, white solid, mp 129−130 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 12.18 (br s, 1H), 7.43−7.29, 7.28−7.20 (m each, 12:3H), 6.04 (s, 1H), 5.29 (d, J = 7.9 Hz, 1H), 2.63 (s, 1H), 2.34 (s, 3H), 2.06 (m, 1H), 1.86, 1.38 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.8, 166.5, 141.8, 141.5, 141.3, 128.8, 128.3, 127.6, 127.1, 125.9, 90.5, 62.1, 32.9, 26.9, 17.5, 14.5; HRMS (EI) calcd for $C_{26}H_{25}NOS$ $[M + H]^+$ 400.1735, found 400.1736.

(E)-3-(Cyclohexylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z5**): 510 mg, yield 81%, white solid, mp 99−100 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.24 (br s, 1H), 7.15, 7.05, 7.00 (m each, 2:1:2H), 4.99 (s, 1H), 3.43 (m, 1H), 2.40 (m, 1H), 2.23 (s, 3H), 1.90 (m, 3H), 1.62, 1.45, 1.20 (m each, 3:1:6H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.8, 166.0, 142.0, 128.3, 125.8, 125.7, 88.9, 52.7, 33.2, 32.7, 26.5, 25.4, 24.4, 14.1, 17.1; HRMS (EI) calcd for $C_{19}H_{25}NOS$ $[M + H]^+$ 316.1735, found 316.1736.

(E)-3-(Cycloheptylamino)-3-(thiomethyl)-1-(2-phenyl)-cyclopropylprop-2-en-1-one (**3z6**): 540 mg, yield 82%, white solid, mp 84−85 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.43 (br s, 1H), 7.23, 7.13, 7.08 (d each, J = 7.3 Hz, 2:1:2H), 3.72 (m, 1H), 2.51 (m, 1H), 2.30 (s, 3H), 1.99, 1.69−1.58, 1.22 (m, 3:11:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.4, 165.6, 141.7, 128.0, 125.6, 88.6, 54.7, 35.0, 32.5, 27.9, 26.2, 23.7, 23.6, 16.9, 13.9; HRMS (EI) calcd for $C_{20}H_{27}NOS$ $[M + H]^+$ 330.1892, found 330.1891.

(E)-3-(2-Tertrahydrofurylmethylamino)-3-(thiomethyl)-1-(2-phenyl)cyclopropylprop-2-en-1-one (**3z7**): 512 mg, yield 81%, white solid, mp 109−110 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.34 (br s, 1H), 7.23, 7.13, 7.10 (m each, 2:1:2H), 5.12 (s, 1H), 4.12, 3.94 (m, 1:1H), 3.75 (m, 1H), 3.48 (m, 2H), 2.52, (m, 1H), 2.31 (s, 3H), 1.92−1.85, 1.66, 1.22 (m each, 4:2:1, 7H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.1, 167.0, 141.8, 128.1, 125.7, 125.6, 89.4, 76.8, 68.2, 47.6, 32.6, 28.8, 26.4, 25.6, 17.1, 13.9; HRMS (EI) calcd for $C_{18}H_{23}NO_2S$ $[M + H]^+$ 318.1528, found 318.1528.

(E)-3-(Benzylamino)-3-(thioethyl)-1-(2-phenyl)cyclopropylprop-2-en-1-one (**3z8**): 609 mg, yield 90%, white solid, mp 82−83 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.50 (t, 1H), 7.22, 7.06 (m each, 7:3H), 5.12 (s, 1H), 4.37 (d, J = 5.9 Hz, 2H), 2.79 (m, 2H), 1.19 (t, J = 7.2 Hz, 3H), 2.36 (m, 1H), 1.80, 1.55, 1.12 (m each, 1:1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.4, 166.4, 141.8, 137.3, 128.7, 128.2, 127.5, 127.3, 125.8, 90.4, 47.7, 32.7, 26.7, 25.6, 17.3, 13.5; HRMS (EI) calcd for $C_{21}H_{23}NOS$ $[M + H]^+$ 338.1579, found 338.15745.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-(4-methyl phenyl)-cyclopropylprop-2-en-1-one (**3z9**): 490 mg, yield 73%, white solid, mp 79−80 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.58 (t, 1H), 7.43,

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J. Org. Chem. 2018, 83, 5731−5750

7.11, 7.04 (m each, 5:2:2H), 5.21 (s, 1H), 4.54 (d, J = 6.0 Hz, 2H), 2.55 (m, 1H), 2.37, 2.34 (s, 3:3H), 1.99 (m, 1H), 1.67, 1.27 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.9, 167.3, 138.9, 137.4, 135.5, 129.1, 128.8, 127.7, 127.42, 125.9, 89.9, 47.8, 32.8, 26.7, 21.1, 17.2, 14.4; HRMS (EI) calcd for $C_{21}H_{23}NOS$ $[M + H]^+$ 338.1579, found 338.1575.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-(4-methoxyl)phenyl)-cyclopropylprop-2-en-1-one (**3z10**): 586 mg, yield 83%, white solid, mp 74−75 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.66 (t, 1H), 7.43, 7.11, 6.88 (m each, 5:2:2H), 5.26 (s, 1H), 4.56 (d, J = 6.0 Hz, 2H), 3.80 (s, 3H), 2.62 (m, 1H), 2.37 (s, 3H), 2.03 (m, 1H), 1.71, 1.28 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.6, 167.1, 157.8, 137.2, 133.6, 128.6, 127.4, 127.2, 126.9, 113.7, 89.7, 55.1, 47.6, 32.4, 26.1, 16.9, 14.1; HRMS (EI) calcd for $C_{21}H_{23}NO_2S$ $[M + H]^+$ 354.1528, found 354.1524.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-(4-bromo)phenyl)-cyclopropylprop-2-en-1-one (**3z11**): 708 mg, yield 88%, white solid, mp 100−101 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.61 (br s, 1H), 7.53, 6.98 (m each, 7:2H), 5.21 (s, 1H), 4.53 (d, J = 6.0 Hz, 2H), 2.54 (m, 1H), 2.35 (s, 3H), 1.98 (m, 1H), 1.75, 1.23 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.9, 167.5, 140.9, 137.1, 119.4, 131.2, 128.7, 127.6, 127.5, 127.3, 89.7, 47.7, 32.7, 26.0, 17.3, 14.2; HRMS (EI) calcd for $C_{20}H_{20}B_rNOS$ $[M + H]^+$ 402.0527, found 402.0523.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-(3-methyl)phenyl)-cyclopropylprop-2-en-1-one (**3z12**): 561 mg, yield 83%, white solid, mp 71−72 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.71 (br s, 1H), 7.55, 7.26, 7.10, 7.07 (m each, 5:1:1:2H), 5.29 (s, 1H), 4.60 (d, J = 6.0 Hz, 2H), 2.58 (m, 1H), 2.40, 2.42 (s each, 3:3H), 2.06 (m, 1H), 1.79, 1.37 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.5, 167.2, 141.7, 137.7, 137.2, 128.6, 128.2, 127.5, 127.2, 126.6, 122.8, 89.8, 47.6, 32.7, 26.7, 21.3, 17.2, 14.1; HRMS (EI) calcd for $C_{21}H_{23}NOS$ $[M + H]^+$ 338.1579, found 338.1576.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-(3-trifluoromethyl)-phenyl)cyclopropylprop-2-en-1-one (**3z13**): 400 mg, yield 84%, white solid, mp 110−111 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.63 (br s, 1H), 7.45−7.27 (m, 9H), 5.24 (s, 1H), 4.54 (d, J = 6.0 Hz, 2H), 2.57 (m, 1H), 2.37 (s, 3H), 2.00 (m, 1H), 1.73, 1.30 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.8, 167.8, 143.0, 137.2, 130.6 (q, J = 31.9 Hz), 128.8, 128.7, 127.7, 127.4, 124.2 (q, J = 272.4 Hz), 122.6, 89.8, 47.8, 32.8, 26.2, 17.5, 14.2; HRMS (EI) calcd for $C_{21}H_{20}F_3NOS$ $[M + H]^+$ 392.1296, found 392.1295.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-(1-fluoro)phenyl)-cyclopropylprop-2-en-1-one (**3z14**): 560 mg, yield 82%, white solid, mp 86−87 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.65 (br s, 1H), 7.41, 7.19, 7.09 (m each, 5:1:3H), 5.24 (s, 1H), 4.54 (d, J = 6.0 Hz, 2H), 2.75 (m, 1H), 2.36 (s, 3H), 2.07 (m, 1H), 1.74, 1.35 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.2, 167.4, 161.5 (d, J = 246.0 Hz), 137.2, 128.9 (d, J = 13.9 Hz), 128.7, 127.5, 127.3, 127.1 (d, J = 8.0 Hz), 126.6 (d, J = 4.2 Hz), 123.8 (d, J = 3.6 Hz), 115.1 (d, J = 22.0 Hz), 89.7, 47.6, 30.9, 20.1 (d, J = 4.6 Hz), 15.9, 14.1; HRMS (EI) calcd for $C_{20}H_{20}FNOS$ $[M + H]^+$ 342.1328, found 342.1322.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-thiophenyl)-cyclopropylprop-2-en-1-one (**3z15**): 560 mg, yield 85%, white solid, mp 90−91 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.57 (br s, 1H), 7.37−7.30 (m, 5H), 7.07, 6.98, 6.83 (m each, 1:1:1H), 5.22 (s, 1H), 4.54 (d, J = 5.9 Hz, 2H), 2.87 (m, 1H), 2.39 (s, 3H), 2.07 (m, 1H), 1.70, 1.27 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.9, 167.6, 146.4, 137.3, 128.8, 127.7, 127.4, 126.9, 123.3, 122.4, 89.9, 47.8, 33.4, 22.2, 18.4, 14.4; HRMS (EI) calcd for $C_{18}H_{19}NOS_2$ $[M + H]^+$ 330.0986, found 330.0984.

(E)-3-(4-Clorobenzylamino)-3-(thiomethyl)-1-(2-(4-bromo)-phenyl)cyclopropylprop-2-en-1-one (**3z16**): 680 mg, yield 78%, white solid, mp 104−105 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.46 (br s, 1H), 7.26, 7.20, 7.13, 6.86 (d each, J = 8.3, 8.4, 8.8 Hz, 2:2:2:2H), 5.08 (s, 1H), 4.37 (d, J = 6.0 Hz, 2H), 2.35 (m, 1H), 2.25 (s, 3H), 1.83 (m, 1H), 1.55, 1.18 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.3, 167.5, 140.9, 135.8, 133.4, 119.5, 131.3, 128.9, 128.7, 127.7, 90.1, 47.0, 32.7, 26.2, 17.5, 14.3; HRMS (EI) calcd for $C_{20}H_{19}BrClNOS$ $[M + H]^+$ 436.0138, found 436.0137.

(E)-3-(Benzylamino)-3-(thiomethyl)-1-(2-phenylvinyl)-cyclopropylprop-2-en-1-one (**3z17**): 424 mg, yield 61%, white solid, mp 94−96 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.58 (br s, 1H), 7.39−7.19 (m, 10H), 6.54 (d, J = 15.8 Hz, 1H), 5.85 (dd, J = 15.7, 8.9 Hz, 1H), 5.22 (s, 1H), 4.54 (d, J = 5.9 Hz, 2H), 2.39 (s, 3H), 2.27, 1.91 (m each, 1:1H), 1.67, 1.05 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 191.6, 167.3, 137.4, 137.3, 132.0, 129.1, 128.8, 128.5, 127.6, 127.4, 126.9, 125.7, 89.9, 47.7, 30.3, 26.4, 16.5, 14.3; HRMS (EI) calcd for $C_{22}H_{23}NOS$ $[M + H]^+$ 350.1579, found 350.1580.

(E)-3-(Benzylamino)-1-(2-methyl-3-phenylcyclopropyl)-3-(methylthio)prop-2-en-1-one (**3z18**): 273 mg, yield 81%, white solid, mp 86−87 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.65 (br s, 1H), 7.42, 7.20 (m each, 7:3H), 5.28 (s, 1H), 4.61 (m, 2H), 2.60 (m, 1H), 2.38 (s, 3H), 2.16 (m, 1H), 1.80 (m, 1H), 1.43 (d, J = 6.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.9, 166.7, 142.3, 137.4, 128.7, 128.2, 127.4, 127.2, 125.9, 125.6, 91.3, 47.6, 37.8, 31.3, 27.1, 14.2, 11.8; HRMS (EI) calcd for $C_{21}H_{23}NOS$ $[M + H]^+$ 338.1579, found 338.1578.

(E)-3-(Benzylamino)-1-(2-(4-fluorophenyl)-3-methylcyclopropyl)-3-(methylthio)prop-2-en-1-one (**3z19**): 259 mg, yield 73%, white solid, mp 99−100 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 11.62 (br s, 1H), 7.35, 7.08, 6.97 (m each, 5:2:2H), 5.25 (s, 1H), 4.52 (m, 2H), 2.54 (t, 1H), 2.36 (s, 3H), 2.06, 1.67 (m each, 1:1H), 1.37 (d, J = 6.2 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 190.7, 166.9, 161.1 (d, J = 243.5 Hz), 137.8 (d, J = 3.0 Hz), 137.4, 128.7, 127.4, 127.3, 115.0, 114.8, 91.2, 47.6, 37.5, 30.4, 26.9, 14.2, 11.7; HRMS (EI) calcd for $C_{21}H_{22}FNOS$ $[M + H]^+$ 356.11484, found 356.11485.

(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4a**): 114 mg, yield 75%, white solid, mp 42−43 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.37−7.26 (m, 6H), 4.48 (d, J = 5.9 Hz, 2H), 2.62 (m, 1H), 2.25 (s, 3H), 2.13 (s, 3H), 0.88, 0.82 (m, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.9, 160.0, 138.4, 128.8, 127.9, 127.6, 116.6, 43.8, 20.9, 18.3, 14.2, 6.8; HRMS (EI) calcd for $C_{16}H_{19}NO_3S$ $[M + H]^+$ 306.1164, found 306.1165.

(E)-3-(o-Methylbenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4b**): 128 mg, yield 80%, white solid, mp 52−54 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.19−7.01 (m, 5H, NH), 4.37 (d, J = 5.5 Hz, 2H), 2.52 (m, 1H), 2.24 (s, 3H), 2.15 (s, 3H), 2.03 (s, 3H), 0.78, 0.70 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.6, 160.1, 136.3, 135.8, 130.5, 128.4, 127.7, 126.2, 116.3, 41.8, 20.8 19.0, 18.2, 14.1, 6.8; HRMS (EI) calcd for $C_{17}H_{21}NO_3S$ $[M + H]^+$ 320.1320, found 320.1321.

(E)-3-(m-Methylbenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4c**): 115 mg, yield 72%, white solid, mp 54−55 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.27 (br s, 1H), 7.20 (d, J = 7.2 Hz, 1H), 7.08 (m, 3H), 4.43 (d, J = 5.8 Hz, 2H), 2.61 (m, 1H), 2.33 (s, 3H), 2.23 (s, 3H), 2.12 (s, 3H), 0.88, 0.80 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 163.9, 160.1, 138.5, 138.2, 128.7, 128.6, 128.3, 124.9, 116.5, 43.8, 21.5, 21.0, 18.3, 14.3, 6.9; HRMS (EI) calcd for $C_{17}H_{21}NO_3S$ $[M + H]^+$ 320.1320, found 320.1320.

(E)-3-(p-Methylbenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4d**): 112 mg, yield 70%, white solid, mp 52−53 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.25 (br s, 1H), 7.13, 7.10 (d each, J = 7.9 Hz, 2:2H), 4.38 (d, J = 5.8 Hz, 2H), 2.56 (m, 1H), 2.29 (s, 3H), 2.19 (s, 3H), 2.08 (s, 3H), 0.84, 0.76 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.4, 163.6, 159.6, 136.9, 135.1, 129.2, 127.6, 116.4, 43.3, 20.9, 20.7, 14.0, 6.6; HRMS (EI) calcd for $C_{17}H_{21}NO_3S$ $[M + H]^+$ 320.1320, found 320.1318.

(E)-3-(o-Methoxylbenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4e**): 134 mg, yield 80%, white solid, mp 57−58 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.27 (br s, 1H), 7.21 (t, J = 7.8 Hz, 1H), 6.75 (m, 3H), 4.42 (d, J = 5.9 Hz, 2H), 3.77 (s, 3H), 2.59 (m, 1H), 2.22 (s, 3H), 2.10 (s, 3H), 0.85, 0.77 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.7, 160.0, 159.9, 139.9, 129.7, 119.9, 113.2, 113.1, 116.4, 55.3, 43.7, 20.9, 18.2, 14.2, 6.8; HRMS (EI) calcd for $C_{17}H_{21}NO_4S$ $[M + H]^+$ 336.1270, found 336.1270.

(E)-3-(o-Flourbenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4f**): 120 mg, yield 74%, white solid, mp 83−84 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.33, 7.24, 7.07 (m each, 2:1:2 H, NH), 4.51 (d, J = 6.0 Hz, 2H), 2.59 (m, 1H), 2.21 (s, 3H), 2.11 (s, 3H),

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J. Org. Chem. 2018, 83, 5731−5750

0.87, 0.83 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.9, 162.3, 160.1 (d, J = 246.2 Hz), 130.3 (d, J = 4.3 Hz), 129.4 (d, J = 8.1 Hz), 124.4 (d, J = 3.6 Hz), 115.4, 125.2 (d, J = 14.8 Hz, C_6H_4), 116.4, 37.7 (d, J = 4.0 Hz), 21.0, 18.2, 14.3, 6.9; HRMS (EI) calcd for $C_{16}H_{18}FNO_3S$ $[M + H]^+$ 324.1070, found 324.1075.

*(E)-3-(o-Bromobenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4g**):* 150 mg, yield 78%, white solid, mp 64−65 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.54 (d, J = 12.9, 1H), 7.52 (br s, 1H), 7.37 (d, J = 6.9 Hz), 7.27 (t, J = 7.2 Hz), 7.13 (m, 1:1:1H), 4.53 (d, J = 6.1 Hz, 2H), 2.62 (m, 1H), 2.22 (s, 3H), 2.11 (s, 3H), 0.88, 0.84 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.4, 163.8, 160.3, 137.3, 123.7, 132.8, 130.2, 129.2, 127.7, 116.2, 43.9, 20.9, 18.2, 14.2, 6.8; HRMS (EI) calcd for $C_{16}H_{18}BrNO_3S$ $[M + H]^+$ 384.0269, found 384.0268.

*(E)-3-(m-Bromobenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4h**):* 144 mg, yield 75%, white solid, mp 67−68 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.41 (br s, 1H), 7.37, 7.20, 7.17 (m, 2:1:1H), 4.41 (d, J = 6.1 Hz, 2H), 2.59 (m, 1H), 2.22 (s, 3H), 2.11 (s, 3H), 0.86, 0.80 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 164.1, 160.5, 140.8, 122.7, 130.6, 130.5, 130.3, 126.3, 116.14, 43.0, 20.9, 18.3, 14.2, 6.9; HRMS (EI) calcd for $C_{16}H_{18}BrNO_3S$ $[M + H]^+$ 384.0269, found 384.0265.

*(E)-3-(p-Bromobenzylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4i**):* 140 mg, yield 73%, white solid, mp 66−68 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.42, 7.14 (d each, J = 8.0 Hz, 2:2H), 7.36 (br s, 1H), 4.39 (d, J = 6.0 Hz, 2H), 2.60 (m, 1H), 2.21 (s, 3H), 2.10 (s, 3H), 0.85, 0.79 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.9, 160.7, 137.5, 121.3, 131.8, 129.5, 116.0, 43.0, 21.0, 18.4, 14.3, 6.9; HRMS (EI) calcd for $C_{16}H_{19}BrNO_3S$ $[M + H]^+$ 384.0269, found 384.0265.

*(E)-3-(Phenylethylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4j**):* 126 mg, yield 79%, yellow liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.23, 7.14 (m each, 2:3H), 7.02 (br s, 1H), 3.46 (q, J = 6.6 Hz, 2H), 2.76 (t, 2H), 2.52 (m, 1H), 2.08 (s, 3H), 2.01 (s, 3H), 0.80, 0.73 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.8, 160.2, 138.9, 128.8, 128.6, 126.5, 116.2, 40.8, 35.5, 21.0, 18.1, 14.2, 6.8; HRMS (EI) calcd for $C_{17}H_{21}NO_3S$ $[M + H]^+$ 320.1320, found 320.1323.

*(E)-3-(Thienylmethylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4k**):* 101 mg, yield 79%, white solid, mp 42−43 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.11 (br s, 1H), 5.85 (m, 1H), 5.20 (dd, J = 17.2, 1.5 Hz, 1H), 5.14 (dd, J = 10.3, 1.2 Hz, 1H), 3.89 (m, 2H), 2.61 (m, 1H), 2.27 (s, 3H), 2.16 (s, 3H), 0.88, 0.82 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.8, 160.4, 134.2, 116.4, 116.3, 42.2, 21.1, 18.4, 14.3, 6.9; HRMS (EI) calcd for $C_{12}H_{17}NO_3S$ $[M + H]^+$ 256.1007, found 256.1013.

*(E)-3-(Isobutylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4l**):* 119 mg, yield 88%, white solid, mp 54−55 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.03 (br s, 1H), 3.04 (t, J = 6.4 Hz, 2H), 2.54 (m, 1H), 2.21 (s, 3H), 2.10 (s, 3H), 1.74 (m, 1H), 0.87 (d, J = 6.7 Hz, 6H), 0.80, 0.72 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.8, 159.4, 116.6, 47.0, 28.5, 21.0, 20.1, 18.2, 14.1, 6.6; HRMS (EI) calcd for $C_{13}H_{22}NO_3S$ $[M + H]^+$ 272.1320, found 272.1321.

*(E)-1-Cyclopropyl-3-(cyclopropylamino)-2-(methylthio)-3-oxoprop-1-en-1-yl Acetate (**4m**):* 103 mg, yield 81%, white solid, mp 70−71 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.01 (br s, 1H), 2.65 (m, 1H), 2.51 (m, 1H), 2.16 (s, 3H), 2.11 (s, 3H), 0.75, 0.42 (m each, 6:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 165.5, 159.8, 116.2, 22.8, 21.1, 18.2, 14.2, 6.8; HRMS (EI) calcd for $C_{12}H_{17}NO_3S$ $[M + H]^+$ 256.1007, found 256.1007.

*(E)-3-(Cyclohexylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4n**):* 120 mg, yield 81%, white solid, mp 55−56 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 6.75 (br s, 1H), 3.70 (m, 1H), 2.47 (m, 1H), 2.18 (s, 3H), 2.08 (s, 3H), 1.83, 1.63, 1.53, 1.31, 1.12 (m each, 2:2:1:2:3H), 0.78, 0.70 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 162.8, 157.9, 117.2, 47.9, 32.9, 25.5, 24.7, 20.9, 17.8, 13.9, 6.5; HRMS (EI) calcd for $C_{15}H_{23}NO_3S$ $[M + H]^+$ 298.1477, found 298.1478.

*(E)-3-(Cycloheptylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4o**):* 173 mg, yield 84%, white solid, mp 64−65 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 6.80 (br s, 1H), 3.87 (m, 1H), 2.45 (m, 1H), 2.17 (s, 3H), 2.07 (s, 3H), 1.82, 1.60−1.38 (m each, 2:10H), 0.76, 0.69 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 162.5, 157.8, 117.2, 50.2, 34.9, 27.9, 23.9, 20.8, 17.7, 13.8, 6.4; HRMS (EI) calcd for $C_{16}H_{25}NO_3S$ $[M + H]^+$ 312.1633, found 312.1634.

*(E)-3-((Tetrahydrofuran-2-yl)methylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4p**):* 97 mg, yield 65%, white solid, mp 52−53 °C; ^1H NMR (400 MHz, $CDCl_3$) ^1H NMR (400 MHz, $CDCl_3$) δ 7.31 (br s, 1H), 3.95 (m, 1H), 3.84, 3.72 (m each, 1:1H), 3.52, 3.19 (m each, 1:1H), 2.59 (m, 1H), 2.24 (s, 3H), 2.14 (s, 3H), 1.90 (m, 4H), 0.84, 0.77 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.9, 159.9, 116.6, 77.6, 68.2, 43.4, 28.6, 25.9, 21.0, 18.3, 14.3, 6.8; HRMS (EI) calcd for $C_{14}H_{21}NO_4S$ $[M + H]^+$ 300.1270, found 300.1265.

*(E)-Ethyl 2-(3-Acetoxy-3-cyclopropyl-2-(methylthio)acrylamido) Acetate (**4q**):* 99 mg, yield 66%, colorless liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.51 (t, 1H), 4.19 (m, 2H), 4.03 (m, 2H), 2.62 (m, 1H), 2.31 (s, 3H), 2.15 (s, 3H), 1.26 (t, J = 7.2 Hz, 3H), 0.88, 0.79 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 169.8, 168.4, 163.9, 160.9, 115.9, 61.4, 41.5, 20.9, 18.2, 14.2, 14.1, 6.90; HRMS (EI) calcd for $C_{13}H_{19}NO_5S$ $[M + H]^+$ 302.1062, found 302.1063.

*(E)-Methyl 2-(3-Acetoxy-3-cyclopropyl-2-(methylthio)-acrylamido)-2-phenyl Acetate (**4r**):* 123 mg, yield 68%, colorless liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, J = 7.5 Hz, 1H), 7.38−7.27 (m, 5H), 5.54 (d, J = 7.5 Hz, 1H), 3.67 (s, 3H), 2.57 (m, 1H), 2.26 (s, 3H), 2.05 (s, 3H), 0.84, 0.75 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 171.1, 168.4, 163.2, 160.3, 136.2, 128.9, 128.5, 127.2, 116.1, 56.5, 52.6, 20.8, 17.9, 14.1, 6.8 6.7; HRMS (EI) calcd for $C_{18}H_{21}NO_5S$ $[M + H]^+$ 364.1219, found 364.1217.

*N-Acetyl-3-cyclopropyl-2-(methylthio)-3-oxo-N-phenylpropanamide (**4s'**):* 90 mg, yield 62%, yellow solid, mp 101−102 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.43, 7.18 (m each, 3:2H), 5.29 (s, 1H), 2.80 (m, 1H), 2.03 (s, 6H), 1.10, 0.96 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 200.7, 172.9, 169.6, 138.8, 129.8, 129.1, 128.8, 60.9, 26.3, 19.8, 13.8, 11.5, 11.4; HRMS (EI) calcd for $C_{15}H_{17}NO_3S$ $[M + H]^+$ 292.1007, found 292.1007.

*N-Acetyl-3-cyclopropyl-2-(methylthio)-3-oxo-N-(p-tolyl)-propanamide (**4t'**):* 70 mg, yield 46%, yellow solid, mp 104−105 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.27, 7.08 (d each, J = 8.4, 8.0 Hz, 2:2H), 5.32 (s, 1H), 2.40 (s, 3H), 2.32 (m, 1H), 2.11, 2.05 (s each, 3:3H), 1.11, 1.01 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 200.8, 173.3, 169.8, 139.3, 136.2, 130.6, 128.6, 60.9, 26.4, 21.3, 19.9, 13.8, 11.6, 11.5; HRMS (EI) calcd for $C_{16}H_{19}NO_3S$ $[M + H]^+$ 306.1164, found 306.1163.

*(E)-3-(1-Phenylethylamino)-2-(thiomethyl)-3-oxo-1-cyclopropyl-1-enyl Acetate (**4u**):* 118 mg, yield 74%, white solid, mp 58−59 °C, 99% ee, $[\alpha]_D^{20}$ +1.23 (c 1.00, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.35, 7.27 (m each, 4:1H), 7.16 (d, J = 8.0 Hz, 1H), 5.15 (m, 1H), 2.56 (m, 1H), 2.23 (s, 3H), 2.09 (s, 3H), 1.52 (d, J = 6.9 Hz, 3H), 0.88, 0.78 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 163.1, 158.7, 143.1, 128.7, 127.4, 126.3, 117.0, 48.7, 21.9, 20.9, 17.9, 14.0, 6.7; HRMS (EI) calcd for $C_{17}H_{21}NO_3S$ $[M + H]^+$ 320.1320, found 320.1322; HPLC (OD-H column, *i*PrOH/hexane 30:70, 0.7 mL/min, 230 nm) t_1 = 8.8 min (major), t_2 = 23.7 min.

*(E)-1-Cyclopropyl-3-((((1R,4aS,10aR)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methyl)amino)-2-(methylthio)-3-oxoprop-1-en-1-yl Acetate (**4v**):* 206 mg, yield 83%, colorless liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.17 (d, J = 8.2 Hz, 1H), 7.13 (t, J = 6.3 Hz, 1H), 6.99 (dd, J = 8.2, 1.3 Hz, 1H), 6.89 (s, 1H), 3.21 (m, 2H), 2.86, 2.60, 2.30 (m, 3:1:1H), 2.21 (s, 3H), 2.10 (s, 3H), 1.92, 1.69, 1.45, 1.24, 0.97, 0.82 (m each, 1:2:4:9:3:5H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.2, 163.8, 159.5, 146.9, 145.4, 134.6, 116.6, 126.8, 124.1, 123.7, 50.3, 45.9, 38.3, 37.4, 37.5, 36.1, 33.4, 30.2, 26.8, 25.2, 23.9, 23.8, 20.8, 18.9, 18.5, 18.4, 18.2, 14.0, 6.6, 6.5; HRMS (EI) calcd for $C_{29}H_{42}NO_3S$ $[M + H]^+$ 484.2885, found 484.2880.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4w**):* 149 mg, yield 78%, white solid, mp 72−73 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.32, 7.20, 7.13 (m each, 8:1:2H), 4.48 (d, J = 5.9 Hz, 2H), 2.84 (m, 1H), 2.35 (m, 1H), 2.20, 2.17 (s each, 3:3H), 1.39 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$)

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δ 168.6, 163.9, 158.5, 140.5, 138.3, 128.8, 128.6, 127.9, 127.6, 126.4, 126.3, 117.1, 43.8, 26.1, 24.7, 21.1, 18.5, 15.4; HRMS (EI) calcd for $C_{22}H_{24}NO_3S$ $[M + H]^+$ 382.1477, found 382.1473.

*(E)-3-(2-Bromobenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4x**):* 191 mg, yield 83%, white solid, mp 82−83 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 7.9 Hz, 1H), 7.53 (t, 1H), 7.41, 7.30, 7.27 (m each, 1:3:4H), 4.57 (d, *J* = 6.1 Hz, 2H), 2.87 (m, 1H), 2.43 (m, 1H), 2.21, 2.17 (s each, 3:3H), 1.48 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.8, 158.7, 140.5, 137.3, 123.8, 132.8, 130.3, 129.2, 128.6, 127.8, 126.4, 126.3, 116.9, 44.1, 26.1, 24.7, 21.1, 18.5, 15.5; HRMS (EI) calcd for $C_{22}H_{22}BrNO_3S$ $[M + H]^+$ 460.0582, found 460.0577.

*(E)-3-(3-Bromobenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4y**):* 173 mg, yield 75%, white solid, mp 80−81 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 (s, 1H), 7.39, 7.29, 7.24, 7.14 (m each, 2:2:3:2H), 4.45 (d, *J* = 6.1 Hz, 2H), 2.85, 2.35 (m each, 1:1H), 2.21 2.17 (s each, 3:3H), 1.48 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 164.0, 158.9, 140.7, 140.5, 122.8, 130.8, 130.7, 130.4, 128.6, 126.5, 126.4, 116.8, 43.1, 26.1, 24.8, 21.1, 18.6, 15.4; HRMS (EI) calcd for $C_{22}H_{22}BrNO_3S$ $[M + H]^+$ 460.0582, found 460.0583.

*(E)-3-(4-Bromobenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z**):* 177 mg, yield 77%, white solid, mp 83−84 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45, 7.16 (d each, *J* = 8.4 Hz, 2:2H), 7.37 (t, *J* = 5.8 Hz, 1H), 7.29 (t, *J* = 7.4 Hz, 2H), 7.21 (dt, *J* = 4.1, 1.7 Hz, 1H), 7.12 (m, 2H), 4.42 (d, *J* = 6.0 Hz, 2H), 2.84 2.37 (m each, 1:1H), 2.20, 2.16 (s each, 3:3H), 1.46 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.9, 159.1, 140.5, 137.4, 121.4, 116.7, 131.9, 129.5, 128.6, 126.5, 126.4, 43.1, 26.2, 24.8, 21.2, 18.6, 15.5; HRMS (EI) calcd for $C_{22}H_{22}BrNO_3S$ $[M + H]^+$ 460.0582, found 460.0580.

*(E)-3-(3-Methylbenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z1**):* 142 mg, yield 72%, white solid, mp 70−71 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29, 7.25, 7.11 (m each, 3:2:5H), 4.44 (d, *J* = 5.8 Hz, 2H), 2.92, 2.34 (m each, 1:1H), 2.36 (s, 3H), 2.18, 2.16 (s each, 3:3H), 1.46 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.9, 158.4, 140.6, 138.5, 138.2, 128.7, 128.6, 128.4, 126.5, 126.4, 124.9, 117.2, 43.9, 26.1, 24.7, 21.5, 21.1, 18.5, 15.4; HRMS (EI) calcd for $C_{23}H_{25}NO_3S$ $[M + H]^+$ 396.1633, found 396.1633.

*(E)-3-(4-Chlorobenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z2**).* 151 mg, yield 73%, white solid, mp 69−70 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (br s, 1H), 7.36, 7.28, 7.20 (m each, 4:3:2H), 4.47 (d, *J* = 6.0 Hz, 2H), 2.87, 2.37 (m each, 1:1H), 2.22, 2.18 (s each, 3:3H), 1.50 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.9, 158.9, 140.5, 136.9, 133.3, 116.7, 129.2, 128.9, 128.6, 126.5, 126.4, 43.1, 26.1, 24.8, 21.1, 18.6, 15.4; HRMS (EI) calcd for $C_{22}H_{22}ClNO_3S$ $[M + H]^+$ 416.1087, found 416.1084.

*(E)-3-(4-Trifluorobenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z3**):* 162 mg, yield 72%, white solid, mp 87−88 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59, 7.40 (d each, *J* = 8.0 Hz, 2:2H), 7.46 (br s, 1H), 7.29, 7.20 (m each, 2:1H), 7.13 (d, *J* = 7.3 Hz, 2H), 4.54 (d, *J* = 6.1 Hz, 2H), 2.86, 2.36 (m each, 1:1H), 2.20, 2.18 (s each, 3:3H), 1.45 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 164.1, 159.5, 142.5 (q, *J* = 2.6), 140.4, 129.8 (q, *J* = 32.3 Hz), 128.6, 127.9, 126.5, 126.4, 142.49, 125.7 (q, *J* = 3.8 Hz), 123.6 (q, *J* = 270.8 Hz), 116.5, 43.3, 26.2, 24.9, 21.2, 18.7, 15.5; HRMS (EI) calcd for $C_{23}H_{23}F_3NO_3S$ $[M + H]^+$ 450.1351, found 450.1351.

*(E)-3-(Dibenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z4**):* 201 mg, yield 88%, white solid, mp 80−81 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (br s, 1H), 7.42, 7.25, 7.19 (m each, 12:1:2H), 6.34 (d, *J* = 8.6 Hz, 2H), 2.88, 2.39 (m each, 1:1H), 2.20, 2.14 (s each, 3:3H), 1.52 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.0, 157.7, 141.5, 140.4, 117.4, 128.6, 128.5, 127.4, 127.3, 126.3, 126.2, 56.8, 25.9 24.6, 20.9, 18.2, 15.3; HRMS (EI) calcd for $C_{28}H_{27}NO_3S$ $[M + H]^+$ 458.1790, found 458.1792.

*(E)-3-(Cyclohexylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z5**):* 145 mg, yield 78%, white solid, mp 42−43 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30, 7.21, 7.17 (m each, 2:1:2H), 6.83 (br s, 1H), 3.87 (m, 1H), 2.79, 2.33 (m each, 1:1H), 2.22, 2.21 (s each, 3:3H), 1.98, 1.70, 1.60, 1.40, 1.20 (m each, 2:2:1:4:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 162.8, 156.4, 140.6, 128.5, 126.4, 126.3, 117.9, 48.1, 33.1, 25.9, 25.6, 24.8, 24.4, 21.1, 18.1, 15.2; HRMS (EI) calcd for $C_{21}H_{27}NO_3S$ $[M + H]^+$ 374.1790, found 374.1789.

*(E)-3-(Cycloheptylenzylamino)-2-(thiomethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z6**):* 153 mg, yield 79%, white solid, mp 52−53 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30, 7.20, 7.12 (m each, 2:1:2H), 6.90 (br s, 1H), 3.98 (m, 1H), 2.79, 2.33 (m each, 1:1H), 2.25, 2.21 (s each, 3:3H), 1.95 (m, 2H), 1.60−1.36, 1.34 (m each, 10:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.7, 162.6, 156.5, 140.7, 128.6, 126.4, 126.3, 118.0, 50.4, 35.2, 28.1, 25.8, 24.5, 24.1, 21.2, 18.1, 15.2; HRMS (EI) calcd for $C_{22}H_{29}NO_3S$ $[M + H]^+$ 388.1946, found 388.1947.

*(E)-2-(Methylthio)-3-oxo-1-(2-phenylcyclopropyl)-3-((((tetrahydrofuran-2-yl)methyl)amino)prop-1-en-1-yl Acetate (**4z7**):* 129 mg, yield 69%, yellow liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (t, *J* = 5.3 Hz, 1H), 7.28, 7.18, 7.12 (m each, 2:1:2H), 3.97, 3.85 (m each, 1:1H), 3.73 (m, 1H), 3.55, 3.21 (m each, 1:1H), 2.84, 2.33, 1.91, 1.54, 1.37 (m, 3:1:2H), 2.23, 2.19 (s each, 3:3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.9, 158.4, 140.6, 128.6, 126.5, 126.3, 117.3, 77.7, 68.3, 43.5, 28.7, 26.1, 26.0, 24.7, 21.2, 21.2, 18.5, 15.4; HRMS (EI) calcd for $C_{20}H_{25}NO_4S$ $[M + H]^+$ 376.1583, found 376.1580.

*(E)-3-(Benzylamino)-2-(thioethyl)-3-oxo-1-(2-phenyl) Cyclopropyl-1-enyl Acetate (**4z8**):* 134 mg, yield 68%, white solid, mp 64−65 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30, 7.20, 7.10 (m each, 8:1:2H), 4.47 (d, *J* = 5.8 Hz, 2H), 2.91, 2.36 (m each, 1:1H), 2.57 (m, 2H), 2.23 (s, 3H), 1.40 (m, 2H), 1.19 (m, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 164.2, 160.2, 140.5, 138.3, 114.8, 128.8, 128.6, 127.9, 127.6, 126.4, 126.3, 43.9, 29.5, 26.4, 24.9, 21.2, 15.5, 14.6; HRMS (EI) calcd for $C_{23}H_{25}NO_3S$ $[M + H]^+$ 396.1633, found 396.1633.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-(4-methylphenyl)) Cyclopropyl-1-enyl Acetate (**4z9**):* 142 mg, yield 72%, yellow liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41−7.26 (m, 6H), 7.11, 7.04 (d each, *J* = 8.1 Hz, 2:2H), 4.49 (d, *J* = 5.9 Hz, 2H), 2.83, 2.33 (m, 1:1H), 2.31, 2.27 (s each, 3:3H), 2.10 (s, 3H), 1.38 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.8, 158.6, 138.2, 137.4, 135.9, 116.9, 129.2, 128.7, 127.7, 127.5, 126.2, 43.7, 25.9, 24.4, 21.0, 21.0, 18.4, 15.2; HRMS (EI) calcd for $C_{23}H_{25}NO_3S$ $[M + H]^+$ 396.1633, found 396.1637.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-(4-methoxylphenyl)) Cyclopropyl-1-enyl Acetate (**4z10**):* 171 mg, yield 83%, white solid, mp 72−73 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55−7.26 (m, 6H, NH), 7.06, 6.83 (d each, *J* = 8.7 Hz, 2:2H), 4.48 (d, *J* = 5.9 Hz, 2H), 3.78 (s, $3H_3$), 2.76, 2.30 (m each, 1:1H), 2.20, 2.11 (s each, 3:3H), 1.32 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.9, 158.8, 158.4, 138.3, 132.5, 116.8, 128.8, 127.9, 127.6, 127.5, 114.1, 55.4, 43.8, 25.8, 24.2, 21.1, 18.6, 15.1; HRMS (EI) calcd for $C_{23}H_{25}NO_4S$ $[M + H]^+$ 412.1583, found 412.1584.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-(4-bromophenyl)) Cyclopropyl-1-enyl Acetate (**4z11**):* 168 mg, yield 73%, white solid, mp 75−76 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29, 6.90 (d, *J* = 8.4 Hz, 2:2H), 7.27−7.08 (m, 6H), 4.38 (d, *J* = 5.9 Hz, 2H), 2.69, 2.21 (m each, 1:1H), 2.08, 2.06 (s each, 3:3H), 1.32, 1.23 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.6, 157.6, 139.6, 138.1, 120.0, 117.4, 131.5, 128.7, 127.9, 127.7, 127.5, 43.7, 26.1, 24.0, 20.9, 18.3, 15.2; HRMS (EI) calcd for $C_{22}H_{22}BrNO_3S$ $[M + H]^+$ 460.0582, found 460.0584.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-(3-methylphenyl)) Cyclopropyl-1-enyl Acetate (**4z12**):* 154 mg, yield 78%, yellow liquid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36−7.27 (m, 6H), 7.18, 7.02, 6.95 (m, 1:1:2H), 4.48 (d, *J* = 5.9 Hz, 2H), 2.82, 2.29 (m each, 1:1H), 2.31 (s, 3H), 2.18 (s, 3H), 2.16 (s, 3H), 1.40 (m, $2H_2$); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.9, 158.6, 140.5, 138.3, 138.2, 117.0, 128.8, 128.5, 127.9, 127.6, 127.2, 127.1, 123.3, 43.9, 26.1, 24.7, 21.5, 21.1, 18.6, 15.4; HRMS (EI) calcd for $C_{23}H_{25}NO_3S$ $[M + H]^+$ 396.1633, found 396.1640.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-(3-trifluorophenyl)) Cyclopropyl-1-enyl Acetate (**4z13**):* 173 mg, yield 77%, white solid, mp 68−69 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50−7.27 (m, 10H), 4.51 (d, *J* = 5.9 Hz, 2H), 2.91, 2.41 (m each, 1:1H), 2.22, 2.20

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J. Org. Chem. 2018, 83, 5731−5750

(s each, 3:3H), 1.45 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.7, 157.3, 141.6, 138.2, 131.1 (q, J = 32.1 Hz), 129.7, 129.0, 127.7 (q, J = 3.9 Hz), 123.3 (q, J = 3.6 Hz), 128.8, 127.9, 127.6, 125.5 (q, J = 14.2 Hz), 117.8, 43.9, 26.1, 24.3, 21.1, 18.4, 15.3; HRMS (EI) calcd for $C_{23}H_{22}F_3NO_3S$ $[M + H]^+$ 450.1351, found 450.1352.

*(E)-3-(Benzylamino)-2-(thiomethyl)-3-oxo-1-(2-(2-fluorophenyl)) Cyclopropyl-1-enyl Acetate (**4z14**):* 142 mg, yield 71%, white solid, mp 86−87 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.32, 7.20, 7.07 (m, 6:1:3H), 4.51 (d, J = 5.9 Hz, 2H), 2.91, 2.51 (m, 1:1H), 2.22, 2.21 (s each, 3:3H), 1.41 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.7, 161.7 (d, J = 246.3 Hz), 157.8, 138.2, 128.7, 127.8, 127.5, 127.8 (d, J = 8.0 Hz), 127.5 (d, J = 14.2 Hz), 126.9 (d, J = 3.9 Hz), 124.1 (d, J = 3.6 Hz), 117.6, 115.3 (d, J = 21.9), 43.8, 24.3, 20.9, 18.3 (d, J = 15.1 Hz), 18.2, 14.3; HRMS (EI) calcd for $C_{22}H_{22}FNO_3S$ $[M + H]^+$ 400.1383, found 400.1380.

*(E)-3-(Benzylamino)-2-(methylthio)-3-oxo-1-(2-(thiophen-2-yl)-cyclopropyl)prop-1-en-1-yl Acetate (**4z15**):* 157 mg, yield 81%, white solid, mp 88−89 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.39−7.26 (m, 6H), 7.10, 6.91, 6.83 (m each, 1:1:1H), 4.48 (d, J = 5.9 Hz, 2H), 2.88, 2.52 (m each, 1:1H), 2.21, 2.18 (s each, 3:3H), 1.44, 1.36 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.8, 157.7, 144.8, 138.2, 117.6, 128.9, 127.9, 127.6, 127.1, 123.9, 123.3, 43.9, 26.8, 21.1, 20.1, 18.6, 16.4; HRMS (EI) calcd for $C_{20}H_{21}NO_3S_2$ $[M + H]^+$ 388.1041, found 388.1043.

*(E)-3-(4-Chlorobenzylamino)-2-(thiomethyl)-3-oxo-1-(2-(4-bromophenyl)) Cyclopropyl-1-enyl Acetate (**4z16**):* 217 mg, yield 88%, white solid, mp 92−93 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.32, 7.23, 7.14, 6.92 (d each, J = 8.4 Hz, 2:2H), 7.26 (t, 1H), 4.36 (d, J = 6.0 Hz, 2H), 2.72, 2.21 (m each, 1:1H), 2.11, 2.10 (s each, 3:3H), 1.34, 1.26 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.8, 158.3, 139.6, 136.8, 133.4, 120.2, 131.7, 129.2, 128.9, 128.1, 117.1, 43.7, 26.2, 24.2, 21.1, 18.5, 15.3; HRMS (EI) calcd for $C_{22}H_{21}BrClNO_3S$ $[M + H]^+$ 494.0192, found 494.0192.

*(E)-3-(Benzylamino)-2-(methylthio)-3-oxo-1-(2-((E)-styryl)-cyclopropyl)prop-1-en-1-yl Acetate (**4z17**):* 159 mg, yield 78%, white solid, mp 67−68 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.32, 7.20 (m each, 10:1H), 6.52 (d, J = 15.7 Hz, 1H), 5.85 (dd, J = 15.7 8.6 Hz, 1H), 4.49 (d, J = 5.9 Hz, 2H), 2.75, 2.08 (m each, 1:1H), 2.22, 2.18 (s each, 3:3H), 1.32, 1.15 (m each, 1:1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.4, 163.7, 158.3, 138.2, 137.1, 130.6, 129.9, 128.7, 128.6, 127.8, 127.5, 127.2, 125.9, 116.9, 43.7, 24.2, 24.1, 21.0, 18.5, 14.7; HRMS (EI) calcd for $C_{24}H_{25}NO_3S$ $[M + H]^+$ 408.1633, found 408.1635.

*N-Acetyl-3-cyclopropyl-2-(methylthio)-3-oxo-N-phenylpropanamide (**4z18**):* 138 mg, yield 70%, white solid, mp 72−73 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.31, 7.18, 7.13 (m each, 7:1:2H), 7.06 (t, 1H), 4.50 (m, 2H), 2.61, 2.06, 1.72 (m each, 1:1:1H), 2.22 (s, 3H), 2.13 (s, 3H), 1.27 (d, J = 6.3 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.5, 163.7, 154.3, 140.9, 138.2, 128.7, 128.4, 127.9, 127.6, 126.5, 126.2, 121.2, 43.7, 31.2, 30.7, 24.6, 20.9, 17.3, 13.9; HRMS (EI) calcd for $C_{23}H_{25}NO_3S$ $[M + H]^+$ 396.1633, found 396.1632.

*N-Acetyl-3-cyclopropyl-2-(methylthio)-3-oxo-N-phenylpropanamide (**4z19**):* 140 mg, yield 68%, white solid, mp 113−114 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 7.35, 7.11, 6.99 (m each, 5:2:3H), 4.51 (m, 2H), 2.55, 2.03, 1.68 (m each, 1:1:1H), 2.23 (s, 3H), 2.14 (s, 3H), 1.27 (d, J = 6.3 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 168.6, 163.6, 161.5 (d, J = 244.2 Hz), 154.2, 138.2, 136.5 (d, J = 3.1 Hz), 128.8, 127.9, 127.6, 128.2 (d, J = 7.9 Hz), 115.2 (d, J = 21.4 Hz), 121.4, 43.8, 30.6, 30.5, 24.5, 20.9, 17.4, 13.9; HRMS (EI) calcd for $C_{23}H_{24}FNO_3S$ $[M + H]^+$ 414.1539, found 414.1534.

*(E)-3-(Benzylamino)-1-cyclopropyl-2-(methylthio)-3-oxoprop-1-en-1-yl Pivalate (**4z20**):* 113 mg, yield 65%, colorless liquid; ^1H NMR (400 MHz, $CDCl_3$) δ 7.30 (m, 5H), 6.98 (br s, 1H), 4.45 (d, J = 5.8 Hz, 2H), 2.54 (m, 1H), 2.23 (s, 3H), 1.23 (s, 9H), 0.85, 0.72 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 175.9, 164.2, 157.4, 138.4, 128.8, 127.9, 127.5, 117.6, 43.8, 39.4, 27.2, 17.9, 14.0, 6.6; HRMS (EI) calcd for $C_{19}H_{25}NO_3S$ $[M + H]^+$ 348.1633, found 348.1631.

*(E)-3-(Benzylamino)-1-cyclopropyl-2-(methylthio)-3-oxoprop-1-en-1-yl Benzoate (**4z21**):* 145 mg, yield 79%, yellow solid, mp 72−73 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 8.12, 7.58, 7.44, 7.20 (m each, 2:1:2:5H), 7.12 (br s, 1H), 4.39 (d, J = 5.9 Hz, 2H), 2.64 (m, 1H), 2.29 (s, 3H), 0.84, 0.74 (m each, 2:2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 164.3, 163.9, 157.8, 138.1, 133.7, 130.2, 128.9, 128.6, 128.5, 127.7, 127.4, 117.9, 43.7, 17.9, 14.2, 6.8; HRMS (EI) calcd for $C_{21}H_{21}NO_3S$ $[M + H]^+$ 368.1320, found 368.1321.

*(E)-3-(Benzylamino)-1-cyclopropyl-2-(methylthio)-3-oxoprop-1-en-1-yl 2-iodo Benzoate (**4z22**):* 182 mg, yield 74%, yellow solid, mp 76−77 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 8.02, 7.42, 7.23 (m each, 2:1:7H), 4.44 (m, 2H), 2.66 (m, 1H), 2.30 (s, 3H), 0.92 (m, 4H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 163.9, 163.5, 158.1, 138.0, 132.2, 94.9, 141.4, 133.3, 128.6, 128.1, 127.7, 127.4, 117.7, 43.7, 17.9, 14.1, 6.9; HRMS (EI) calcd for $C_{21}H_{20}NO_3SI$ $[M + H]^+$ 494.0287, found 494.0288.

*(2E,4E)-N-Benzyl-3-hydroxy-5-(4-methoxyphenyl)-2-(thiomethyl)-penta-2,4-dienamide (**8a**):* 79 mg, yield 74%, yellow solid, mp 95−98 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 15.28 (s, 1H), 7.70, 7.53, 7.33 (m each, 1:4:5H), 6.92 (d, J = 8.7 Hz, 2H), 4.56 (d, J = 6.0 Hz, 2H), 3.84 (s, 3H), 2.15 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 173.3, 172.3, 160.9, 138.1, 128.7, 138.4, 129.6, 128.9, 127.7, 114.4, 127.6, 117.9, 96.5, 55.5, 43.7, 20.8; HRMS (EI) calcd for $C_{20}H_{22}NO_3S$ $[M + H]^+$ 356.1320, found 356.1314.

*(2E,4E)-N-Benzyl-3-hydroxy-2-(thiomethyl)-5-(thiophen-2-yl)-penta-2,4-dienamide (**8b**):* 71 mg, yield 71%, yellow solid, mp 105−107 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 15.22 (s, 1H), 7.69 (br s, 1H), 7.65, 7.45 (d each, J = 15.6 Hz, 1:1H), 7.46−7.23 (m, 6H, 1H), 7.24 (d, J = 3.5 Hz, 1H), 7.05 (m, 1H), 4.56 (d, J = 5.9 Hz, 2H), 2.15 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 172.5, 172.1, 141.5, 138.1, 131.4, 129.8, 128.9, 127.7, 127.6, 127.5, 128.2, 119.4, 97.1, 43.7, 20.9; HRMS (EI) calcd for $C_{17}H_{18}NO_2S_2$ $[M + H]^+$ 332.0779, found 332.0774.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acs.joc.8b00775.

Experimental procedures, NMR spectra of the substrates and products, HPLC spectra for racemic and chiral products, and X-ray crystallographic analysis for compounds **2h**, **2o′**, **2p″**, **4f**, and **4s′** (PDF)

Crystal data for compounds **2h**, **2o′**, **2p″**, **4f**, and **4s′** (CIF)

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Notes

The authors declare no competing financial interest.

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