Brèves communications – Kurze Mitteilungen – Brevi comunicazioni – Brief Reports

Tigogenin and Ursolic Acid from *Cestrum diurnum* Linn.

Leaves of *Cestrum diurnum* Linn. (Family, Solanaceae) were found to be rich in saponin. On extraction successively with petroleum ether (40°–60°), ether and 90% ethanol in a soxhlet, two products (A) and (B) were obtained from the ether and the ethanol fractions respectively. Product (A), $C_{30}H_{48}O_3$, m.p. 279–280°C, $[\alpha]_D^{24}$ +62.7° (pyridine), acetate m.p. 283–284°C, was identical with ursolic acid by comparison of mixed m.p. and IR-spectra with an authentic specimen.

Product (B), m.p. 269°C (decomp.), $[\alpha]_D^{23} -48°$ (pyridine), on hydrolysis with 5% hydrochloric acid gave a sugar fraction and a product (C), $C_{27}H_{44}O_3$, m.p. 207–208°C, $[\alpha]_D^{24} -71°$ (chloroform). The product (C) gave an acetate, $C_{29}H_{46}O_4$, m.p. 201–202°C, and a benzoate, $C_{34}H_{48}O_4$, m.p. 229–230°C, and was found to be tigogenin (IR-spectra compared). The sugar fraction on downward paper partition chromatography, using ethyl acetate-pyridine-water (12:5:4) as eluent, showed the presence of xylose, glucose and galactose. The product (B) was found to be tigonin[1,2].

Zusammenfassung. Aus *Cestrum diurnum* Linn. wurden Ursolsäure und Tigonin, $[\alpha]_D^{23}$ –48° (Pyridine) und aus Tigonin Tigogenin durch Hydrolyse isoliert bzw. erhalten.

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A Novel Oxidative Cyclization of 4-Arylthiosemicarbazides and Related Compounds

Thiosemicarbazide and 4-arylthiosemicarbazides are known[1–4] to undergo condensation with suitable reagents to afford different heterocyclic compounds. Likewise, thiosemicarbazones are also known to yield a variety of heterocyclic products either on condensation[5–7] with or oxidation[8–11] by appropriate reagents. Oxidative cyclization of these materials, in general, result in 1,3,4-thiadiazoles, Δ^{-4} 1,3,4-thiadiazolines or 1,2,4-triazoles. A fusion to the aromatic ring borne on the 4-position of the thiosemicarbazide moiety in 4-arylthiosemicarbazides and the thiosemicarbazones, derived therefrom, has not been achieved hitherto by oxidative reactions, although references[12–14] are available on the conversion of 1- or 4-phenylthiosemicarbazide to 2-aminobenzthiazole, in poor yields, by heating with concentrated HCl at 130°.

However, such an attack on the aromatic ring leading to the formation of a benzoheterocycle by the oxidation of an arylthiourea under HUGERSHOFF's[15] conditions is a common and well-exploited reaction for the synthesis of 2-amino- or 2-substituted amino benzthiazoles. In as much as 4-arylthiosemicarbazides can be considered as N-amino derivatives of N'-arylthioureas, it appeared to be of interest to study whether 4-arylthiosemicarbazides and the corresponding thiosemicarbazones obtained from a variety of aromatic aldehydes would undergo a similar cyclization by the action of bromine in chloroform.

We now report that 4-arylthiosemicarbazides undergo oxidative cyclization by bromine in chloroform to 2-hydrazino benzthiazoles (I) in fair yields (50–55%) (Table I, a). 4-Arylthiosemicarbazones of aromatic aldehydes, understandably, are more easily oxidizable under these conditions to 1-arylidene 2-(2'-benzothiazolyl)hydrazines (II) in nearly quantitative yields (Table I, b). Both the sets of compounds have been authenticated by comparison with products prepared by unambiguous methods. The presence of some substituents in either the 4-aryl residue and/or the 1-arylidene moiety in the 4-arylthiosemicarbazones promotes an entirely different mode of cyclization to 3:4-diaryl-5-mercapto-1:2:4-triazoles (III).

The benzthiazolyl hydrazones (II) possess another site for cyclization and since it appeared desirable to achieve

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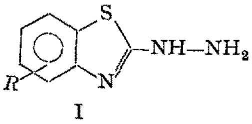
directly a double cyclization, the conversion of 4-arylthiosemicarbazones to 3-aryl-s-triazolo (3,4-*b*)benzthiazoles[16–18] (IV), was sought through the action of a slightly more powerful oxidizing agent, bromine in pyridine. But this reagent caused, instead, cyclization to 2-arylamino-5-aryl-1:3:4-thiadiazoles, a large number of which is known[11,25,26] through the oxidation of 4-arylthiosemicarbazones by ethanolic ferric chloride. Nonetheless, the desired fused benzthiazoles (IV) were synthesized by treatment of II with ethanolic ferric chloride, adopting one of the recent procedures of NAQUI and SRINIVASAN[27], for the synthesis of fused s-triazoles.

Oxidative cyclization of 4-arylthiosemicarbazides and -thiosemicarbazones by bromine in chloroform appears to be an elegant procedure, full of promise for the synthesis of not only simple benzthiazoles but fused benzthiazole systems also. Data on a set of products obtained during these oxidative cyclizations are included in the accompanying Tables. All the new compounds here reported analysed well for their C, H, and N content. Further work is in progress and full details will be published elsewhere.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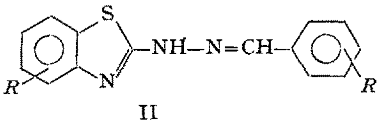
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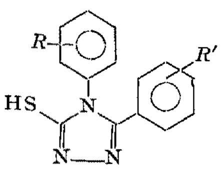
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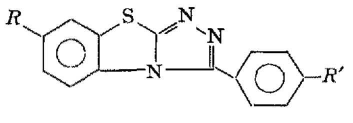
IV

Table I. Oxidation products of 4-arylthiosemicarbazides and -thiosemicarbazones

(a)

	4-Arylthiosemicarbazide oxidized	2-Hydrazinobenzthiazole obtained		
	Substituent in the 4-phenyl residue	Bz-substituent	M.P. °C	Yield %
1	–	–	[a]195[19–21]	54
2	4-Me	6-Me	214–5[22]	52
3	4-OMe	6-OMe	168–9[19]	51

(b)

	1-Arylidene-4-arylthiosemicarbazide oxidized		Product obtained (II or III)				
	Substituent in the 4-phenyl residue	Substituent in 1-benzylidene residue	Type	*R*	*R'*	M.P. °C	Yield %
1	–	–	II	H	H	220–1[20,21]	95
2	–	4-Me	II	H	4-Me	227–8	92
3	–	4-OMe	II	H	4-OMe	193–4[23,24]	94
4	2-Me	4-Me	III	2-Me	4-Me	213–4	55
5	2-Me	4-OMe	III	2-Me	4-OMe	230–1	60
6	3-Me	–	II	5/or 7-Me	H	236–7	89
7	3-Me	4-Me	II	5/or 7-Me	4-Me	225–6	94
8	3-Me	4-OMe	II	5/or 7-Me	4-OMe	221–2	97
9	4-Me	–	II	6-Me	H	248	86
10	4-Me	4-OMe	II	6-Me	4-OMe	218	88
11	4-OMe	–	II	6-OMe	H	211–3	86
12	4-OMe	4-Me	II	6-OMe	4-Me	208–9	89
13	4-OMe	4-OMe	II	6-OMe	4-OMe	210–1	87
14	2-Cl	–	III	2-Cl	H	232–3[18]	68

[a] The reported melting point for this compound varies from 194–205° C.

Table II. 3-Aryl-s-triazolo (3,4-*b*) benzothiazoles (IV) obtained by oxidation of II

R	*R'*	M.P. °C	Yield %
H	H	156–7[17,18]	52
H	OMe	145–6[17]	48
Me	H	173–4	51

Résumé. Il est démontré que les 4-arylthiosemicarbazides sont oxydés par le brome dissous en chloroforme aux 2-hydrazinobenzothiazoles avec de modestes rendements. Une telle réaction sur les thiosémicarbazones correspondants donne les 1-arylidénè 2-(2'-benzothiazolyle)hydrazines avec de très bons rendements. Ceux-ci purent, par la suite, être oxydés par le chlorure de fer^{+3} en solution éthanolique aux 3-aryl-s-triazolo (3,4-*b*)benzothiazoles. La présence de quelques substituants dans les restes 4-aryl et/ou 1-arylidène dans la moitié thiosemicarbazone favoriserait la cyclisation aux 3:4-diaryl-5-mercapto-1:2:4-triazoles.

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