Isolation of gallotannin from the seed pulp. The seed pulp was extracted as above and the EtOAc soluble fraction was redissolved in minimum quantity of solvent and precipitated with excess of $CHCl_3$ (×2) to yield gallotannin as a white amorphous powder m.p. and mixed m.p. (with the gallotannin isolated from mango pannicles[2]) 219–225° (with darkening at 205°).

Gallotannin methyl ether. The methylation of gallotannin was carried out as described earlier.[2,3] TLC of the fully methylated gallotannin was carried out on silica-gel using $CHCl_3$–EtOAc (5:1 v/v[7]) as the developing solvent system. The TLC plates, examined under UV light, indicated the presence of 4 spots, of which one was major. The bands corresponding to the 4 spots were cut out and eluted separately with acetone. Chromatography of each fraction on silica-gel was repeated separately and the elution done in a similar way. The major substance (M) on a final purification through EtOAc–light petroleum ether (40–60°) was obtained as an amorphous white powder, m.p. 125° (with slight sintering at 120°) (Found: C, 58·42; H, 5·35%. Calc. for $C_{74}H_{78}O_{34}$: C, 58·80; H. 5·17%) ν_{max} 1730 cm^{-1} and $[\alpha]_D^{20}$ +18 4° (c, 2·6 in $CHCl_3$), R_f, 0·78 (in $CHCl_3$–EtOAc, 5:1, v/v). One of the remaining 3 minor components (m 1) (R_f, 0·93) was identified as methyl tri-*O*-methylgallate by co-chromatography. The NMR spectrum of compound (M) was determined in $CDCl_3$ at 60 Mc using a Varian A 60 machine.

Acknowledgements—The authors thank Dr. E. Haslam and Dr. S. Rajadurai for the NMR spectra and their interpretation of β-glucogallin and gallotannin. One of us (El Ansari) thanks the Council of Scientific and Industrial Research (India) for the award of a Fellowship under the Exchange Programme.

Phytochemistry, 1971, Vol. 10, pp. 2241 to 2244. Pergamon Press. Printed in England.

COMPOSITAE

SESQUITERPENE LACTONES FROM THE GENUS *AMBROSIA*

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(*Received* 24 *October* 1970)

Abstract—The sesquiterpene lactone constituents of 25 new plant collections from the Southwestern United States, Mexico (including Baja Calif.) and Jamaica, representing 16 different taxa belonging to the genus *Ambrosia*, are described.

IN CONNECTION with our continuing chemosystematic investigation of the genus *Ambrosia*,[1] we wish to report here the sesquiterpene lactone chemistry of 25 new plant collections which represent 16 different *Ambrosia* taxa from the Southwestern United States, Mexico (including Baja Calif.) and Jamaica. No new compounds were encountered in the present investigations. However, the finding of isoalantolactone (VI) in *A. camphorata* from Baja California

[1] See T. J. MABRY, Chap. 13 in *Phytochemical Phylogeny* (edited by J. B. HARBORNE), pp. 269–300, Academic Press, London (1970) for a recent review of the sesquiterpene lactone chemistry of the genus *Ambrosia*.

TABLE 1. THE SESQUITERPENE LACTONE CHEMISTRY OF TWENTY-FIVE NEW

Species	Collection numbers*	Collection site	Yield of crude syrup (%)†
A. acanthicarpa	WP-6608	Roadside ca. 0 5 miles E of Utah state line on Hwy US 6-50. Mesa Co., Colorado (27 June 1969)	2 8
	WP-6619	W of Sedona on Hwy US alt 89, near junction with road to Montezuma Castle Nat'l. Monument. Yavapai Co., Arizona (6 July 1969)	3
A. ambrosioides (Cav.) Payne	WP-6622	Along wash near KOA campground, 13 miles SE of Wickenburg on Hwys US 89-60-70 and Ariz. 93. Maricopa Co., Arizona (7 July 1969)	9 2
A. camphorata (Greene) Payne	ER-53	Guanajuato border on Hwy 57, 8 miles N of San Luis Potosi, Mexico	10 5
	MP-1851	Baja California South about 28 miles W of San Javier (29 March 1970)	10 3
A. 'castanensis ¶	DS-1386	River bed in Castanos, Coahuila, Mexico (28 May 1969)	1 6
A. chenopodiifolia (Benth.) Payne	WP-6629	San Ysidro, hillside in front of Beyer School, not far from US-Mexico boundary. San Diego Co., California (11 July 1969)	8
A. confertiflora DC.	WP-6618	N side of Hwy US alt 89, *ca* 2 miles W of Sedona Yavapai Co., Arizona (6 July 1969)	4
A cordifolia (Gray) Payne	WP-6624	Wash *ca.* 6 9 miles W of Hwy I-10 overpass, on rd from Tucson to Tucson Mtn Park. Pima Co., Arizona (8 July 1969)	10
A. deltoidea (Torr.) Payne	WP-6623	KOA campground grounds, 13 miles SE of Wickenburg on Hwys US 89-60-70 and Ariz. 93. Maricopa Co., Arizona (7 July 1969)	20 8
A. dumosa (Gray) Payne	MP-1716	Baja California North 1 mile S of San Felipe (22 March 1970)	3
A eriocentra (Gray) Payne	WP-6621	Sandy wash 0 6 miles of Hwy S US 89 on Vulture Mine rd, the latter crossing US 89 *ca.*3 5 miles W of junction with Hwy US 60-70 in Wickenburg. Maricopa Co., Arizona (6 July 1969)	3 7
A. grayi (Nels) Shinners	WP-6602	McPherson; vacant lot of 2 blocks S of Main St. at Taft and McKinley Sts McPherson Co , Kans. (24 June 1969)	1 6
	WP-6603	Along Hwy I-70, *ca* 30 miles E of Goodland between mile markers 47 and 48 Thomas Co , Kansas (25 June 1969)	1 2
A. linearis (Rydb) Payne	WP-6604	Calhan, disturbed area along street 2 blocks N of Hwy US 24 and 2 blocks E of Main St. El Paso Co , Colorado (25 June 1969)	0 8
A. 'jamaicensis's	Mdu-Q 223	Westmoreland on main road from Darleston to Newmarket, Jamaica (10 March 1970)	2 4
	Mdu-Q-216	Hagley Gap on path along the Negro River St Thomas, Jamaica (3 March 1970)	3 4
	Mdu-Q 207	North slope of Mt Diablo, St. Ann, Jamaica (27 February 1970)	3 1
	Mdu-Q 217	Mahagony Vale at the border of St Ann and St. Thomas, Jamaica (3 March 1970)	3
A. psilostachya DC.	WP-6601	Pastured roadside *ca.* 40 miles E of Junction City, on Hwy I-70 between mile markers 343 and 342. Wabaunsee Co , Kansas (24 June 1969)	1 4
A. pumila (Nutt.) Gray	WP-6632	Santee, grassy roadside within Gillespie Field airport grounds, San Diego Co., California (12 July 1969)	6
A. tomentosa Nutt.	WP-6605	Calhan, disturbed roadside 1 block N of Hwy US 24 and 2 blocks E of Main St. El Paso Co , Colorado (25 June 1969)	0 4
	WP-6616	N of Flagstaff on Hwy US 89, *ca.* 5 8 miles N of junction with Hwy I-40. Coconino Co , Arizona (5 July 1969)	0 8
	WP-6617	N of Flagstaff on Hwy US 89, *ca.* 6 2 miles N of junction with Hwy I-40 Coconino Co , Arizona (5 July 1969)	0 6
A. trifida L.	WP-6620	Verde River bottoms, E of Cottonwood on Hwy US alt 89 Yavapai Co , Arizona (6 July 1969)	0·8

* We wish to thank a number of individuals for plant collections used in connection with the present investigation: WP, W. Payne, ER, E. Rodriguez, MP, M. Powell, MdQ, M. duQuesnay, BLT, B L. Turner, Vouchers are deposited in the herbaria, Univ of Illinois (WP collections) and Univ of Texas (all other collections)

† Yields of crude syrups as well as individual compounds are based upon dry weight of plant material.

‡ Identification procedure: A—m.p. and or mixed m p., NMR and co-chromatography with authentic specimen.

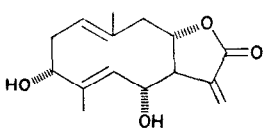
B—NMR and co-chromatography with authentic specimen.

PLANT COLLECTIONS REPRESENTING SIXTEEN TAXA OF THE GENUS *Ambrosia*

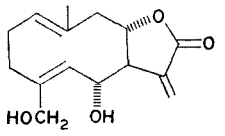
Silica gel chromatography solvent system	Compounds† detected	Identification procedure‡
ether	Chamissonin (I)	B
	Chamissonin diacetate	B
ether	Chamissonin (I) (0·5%)	A
EtOAc	Damsin (VII)	A
$CHCl_3$–methanol (9:1)	Ilicic acid§ (IV) (0·5%)	A
	Costic acid§ (IV)	B
benzene–ether (8:2)	Isoalantolactone (VI) (1%)	A
$CHCl_3$–ether (1:3)	Artemisiifolin (II) (0·1%)	A
benzene–ethyl acetate (1:9)	Damsin (VII)	B
ether	Confertiflorin (VIII) (major)	A
	Desacetylconfertiflorin (IX) (0·2%)	A
ether	Psilostachyin-B (XII)	A
benzene–ethyl acetate (1:9)	Damsin (VII)	A
$CHCl_3$–acetone (7:3)	Parthenolide (III) (0·15%)	A
	Chamissonin (I) (0·1%)	A
	No sesquiterpene lactones detected	
	No sesquiterpene lactones detected	
	No sesquiterpene lactones detected	
	No sesquiterpene lactones detected	
benzene–acetone (4:1)	Damsin (VII) (0·8%)	A
	psilostachyin-C (XIII) (0·57%)	A
	ambrosin (X) (0·43%)	A
benzene–acetone (4:1)	Same as MdQ J-1 by TLC	
benzene–acetone	Same as MduQ J-1 by TLC	
benzene–acetone	Same as MduQ J-1 by TLC	
n-Hexane–ethyl acetate (1:2)	Ambrosiol (XI)	A
EtOAc	Desacetylconfertiflorin	A
	No sesquiterpene lactones detected	
	No sesquiterpene lactones detected	
	No sesquiterpene lactones detected	
	No sesquiterpene lactones detected	

§ These substances, which are not sesquiterpene lactones, are included for completeness.

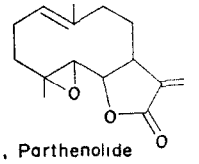
¶ *A.* '*castanesis*' and *A.* '*jamaicensis*' are two taxa which are possible species; both are under further investigation. *A.* '*jamaicensis*' has frequently been designated *A. paniculata* Michx.



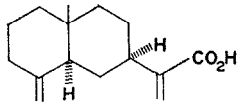
I. Chamissonin



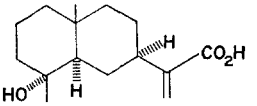
II. Artemisiifolin



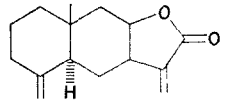
III. Parthenolide



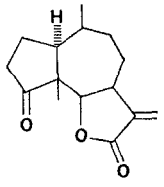
IV. Costic acid



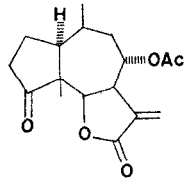
V. Ilicic acid



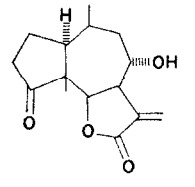
VI. Isoalantolactone



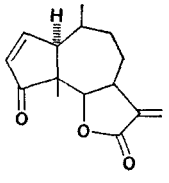
VII. Damsin



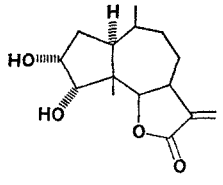
VIII. Confertiflorin



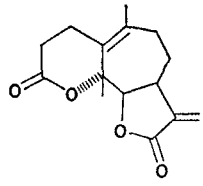
IX. Desacetylconfertiflorin



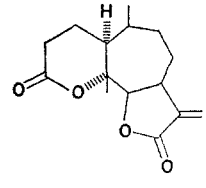
X. Ambrosin



XI. Ambrosiol



XII. Psilostachyin B



XIII. Psilostachyin C

represents the first report of this substance from the genus *Ambrosia*. The entire Baja California complex of *Ambrosia* taxa is presently under intensive chemosystematic analysis.

Of particular interest are the four collections of *Ambrosia* '*jamaicensis*' (see footnote ¶, Table 1) which represent the three widely separated regions where *Ambrosia* occurs in Jamaica. The sesquiterpene lactone data of the four populations were identical indicating a single Jamaican taxon. The compounds damsin, ambrosin and psilostachyin-C, identified from the Jamaican material in the present survey, are also typical for *A. hispida*, *A. cumanensis* and *A. psilostachya* suggesting (as proposed previously by Payne, see Ref. 1) a close evolutionary relationship of the Jamaican taxon to these species.[1]

The detailed systematic implications of the data presented in Table 1 along with a comparative biochemical systematic analysis of South American taxa of *Ambrosia* will be described elsewhere.

EXPERIMENTAL

All plant extractions, NMR and TLC analyses were carried out by standard procedures.[1,2]

Acknowledgements—This investigation was supported by the Robert A Welch Foundation (Grant F-130) and the National Science Foundation (Grants GB-5448X, GB-8091 and GB-16411). Contribution to the Origin and Structure of Ecosystems Integrated Research Program of the International Biological Program.

[2] See, for example, T. J. MABRY, H. E. MILLER, H B KAGAN and W. RENOLD, *Tetrahedron* **22**, 1139 (1966).