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ALKALOIDS OF *CRINUM PRATENSE**

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Key Word Index—*Crinum pratense*; Amaryllidaceae; bulbs; alkaloids; lycorine; 1,2-diacetyllycorine; ambelline; narcissidine; phenanthridone alkaloids; hippadine; pratorinine; anhydrolycorin-7-one.

Abstract—From the bulbs of *Crinum pratense*, collected at flowering, lycorine, 1,2-diacetyllycorine, ambelline, narcissidine, and three phenanthridone alkaloids, viz. hippadine, pratorinine and anhydrolycorin-7-one, were isolated and characterized on the basis of comprehensive spectral analyses (UV, IR, ^{1}H NMR, ^{13}C NMR, MS, $[\alpha]_D$) and chemical evidence. Among the phenanthridone alkaloids (**1**–**3**), only the natural occurrence of hippadine was previously known. Pratorinine is a new phenanthridone alkaloid and anhydrolycorin-7-one was known before only as a synthetic compound. The physiological significance of hippadine is appraised.

INTRODUCTION

Crinum pratense (syn. *C. longifolium*) is cultivated in the upper Gangetic plains in India as a garden flower. An extract of its bulbs is used in popular medicine as a bitter tonic, a laxative and in chest ailments. The species was previously reported [1] to contain only lycorine, the widespread alkaloid of family Amaryllidaceae. We now wish to report the isolation and characterization of seven alkaloids from the bulbs of the title species, collected at flowering.

RESULTS AND DISCUSSION

Extensive column and prep. TLC of the crude alkaloid fractions from petrol and EtOH extracts of dried and powdered bulbs afforded lycorine, 1,2-diacetyllycorine, ambelline, narcissidine, and three phenanthridone alkaloids, viz. hippadine, pratorinine and anhydrolycorin-7-one. Complete characterization of hippadine and pratorinine only is described here.

Hippadine

This alkaloid was previously reported from *Hippeastrum vittatum* [2] and *Crinum bulbispermum* [3] but remained uncharacterized until this investigation. It was obtained from *Crinum pratense* in appreciable yield (*ca* 0.05%), when the bulbs were collected at flowering time. The identity of the latter compound with hippadine was established by direct comparison. Hippadine, mp 209–210° (from *Crinum pratense*) (lit. [2, 3] mp 213–215°), $C_{16}H_9NO_3$ (by combustion analyses and MS), was assigned structure **1** on the basis of comprehensive spectral analyses and chemical evidence. Detailed interpretation of the ^{1}H NMR spectrum of hippadine was provided (Table 1). The ^{13}C NMR spectrum of hippadine is reported for the first time (Table 2). Chemical proof in favour of structure **1** for hippadine was provided by two crucial chemical transformations. Reduction of hippadine by $LiAlH_4$ in ether–tetrahydrofuran afforded anhydrolycorine. Dehydrogenation, on the other hand, of a synthetic sample of anhydrolycorin-7-one by DDQ, in anhydrous benzene under reflux, afforded hippadine in 75% yield.

Takagi and Yamaki some years ago reported [4] a phenanthridone alkaloid, 'N-3', mp 235°, from *Lycoris sanguinea*, to which they assigned structure **1** on the basis of UV, IR, ^{1}H NMR data and limited chemical evidence. Although the properties of 'N-3' [4] are comparable to those reported here for hippadine, there are certain differences, e.g. in the mp and UV data of the two (see Experimental). Direct comparison was not possible due to non-availability of 'N-3'.

Pratorinine

This alkaloid, mp 265–267°, $C_{16}H_{11}NO_3$, exhibited UV maxima closely similar to those of hippadine. In the ^{1}H NMR spectrum (Table 1), one OH and one OMe function appeared in lieu of the methylenedioxy group of hippadine. The chemical shift values of the aromatic H-8 and H-11, and the maximum upfield shift (*ca* 0.4 ppm) experienced by the former proton in the presence of NaOD–D_2O, located the OH at C-9 and therefore the OMe must be at the C-10 position. Hence pratorinine is assigned structure **2**. Chemical proof in favour of this structure was obtained by opening of the methylenedioxy ring of hippadine into OH–OMe groups by heating with NaOMe in DMSO. Similar opening of the methylenedioxy ring is known in acridone [5] and in piperonal and nitro derivatives [6]. Hippadine on heating with NaOMe in DMSO, at 150°, afforded pratorinine in 12% yield. A concomitant opening of the lactam ring of hippadine was expected and realized leading to indolopiperonylic acid (**4**). Pratorinine (**2**) has not been encountered before in nature nor has it been prepared synthetically.

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Table 1. ^{1}H NMR Data* of Hippadine (**1**) and Pratorinine (**2**)

Alkaloid	Protons†							
	H_A	H_B	H_C	H_D	H_E	H_F	H_G	OCH_2O/OMe
1	6.88 *d* (*J* 3.66)	8.03 *d* (*J* 3.66)‡	7.61 *s*	7.95 *s*	7.33 *dd* (J_{EF} 1.0, J_{EG} 7.6)	7.87 *dd* (J_{FG} 7.6, J_{EF} 1.0)	7.44 *t* (J_{EG} 7.6, J_{FG} 7.55)	6.15 *s* (2H)
2	6.90 *d* (*J* 3.70)	8.06 *d* (*J* 3.70)	7.67 *s*	8.1 *s*	7.73 *dd* (J_{EG} 7.6, J_{EF} 1.0)	7.95 *dd* (J_{FG} 7.6, J_{EF} 1.0)	7.45 *dd* ($J_{EG} = J_{FG}$ 7.6)	4.11 *s* (3H)

*In $CDCl_3$, ppm from TMS at zero.
†Decoupling experiments substantiated the assignments.
‡Line broadening.