

### 378. *Alkaloids of New Zealand Senecio Species. Part I. The Alkaloid from Senecio kirkii.*

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A new alkaloid, *senkirkine*,  $C_{18}H_{25}O_4N$ , has been isolated from the bark and leaves of *Senecio kirkii*. Hydrolysis affords senecic acid lactone and an oily necine, probably  $C_8H_{13}O_3N$ , isolated as an amorphous picrate and aurichloride.

THE genus *Senecio*, the largest in the *Compositæ* or flowering plants, contains over a thousand species, and of the individual species examined a large number have been found to contain alkaloids (for a review, see Manske, *Ann. Rev. Biochem.*, 1944, 533). New Zealand has 30 species, all endemic except one, *S. lautus*, which extends to Australia. So far none of the New Zealand species has been examined although the introduced species, *S. jacobæa* ("ragwort"), which has spread over wide areas of New Zealand causing "Winton disease" in horses and cattle (Gilruth, *Rep. New Zealand Dept. Agric.*, 1903, 228), has been examined by Hosking and Brandt (*New Zealand J. Sci. Tech.*, 1936, 17, 638; cf. also Manske, *Canadian J. Res.*, 1931, 5, 651, and Barger and Blackie, *J.*, 1937, 584).

*S. kirkii*, a shrub 6—12 feet high and often epiphytic on other trees, is common over the North Island of New Zealand. From both the leaves and the stem bark there has been isolated by the normal procedure, a new alkaloid,  $C_{18}H_{25}O_4N$ , isomeric with jacobine and retrorsine, for which the name *senkirkine* is proposed. Hydrolysis of the base with baryta affords senecic acid lactone,  $C_{10}H_{14}O_4$ , as the necic acid, and an oily necine, from which only an amorphous picrate and aurichloride were prepared but not analysed. If we assume normal hydrolysis,  $C_{18}H_{25}O_6N_4 + H_2O \longrightarrow C_{10}H_{14}O_4 + C_8H_{13}O_3N$ , then the necine would have the formula  $C_8H_{13}O_3N$ , and be thus identical or isomeric with isatinecine from *S. isatideus* and *S. retrorsus* (de Waal, *Onderstepoort J. Vet. Sci. Animal Ind.*, 1939, 12, 155; 1940, 14, 433) but no details or derivatives are recorded in the abstracts of these papers.

#### EXPERIMENTAL.

2.8 Kg. of the dried bark from trees at Anawhata, near Auckland, collected just before the flowering period, were extracted exhaustively (180 hours) with alcohol in a Soxhlet-type extractor until free from

alkaloid. Most of the alcohol was distilled off from the extract, the final fraction by steam-distillation, which also removed a quantity (0.4%) of volatile oil. The aqueous residue was acidified with acetic acid and decanted from a large amount (30%) of resin. The resin, even after being washed, contained appreciable amounts of alkaloid, which was removed by taking up the resin in ether and extracting it with dilute acetic acid and finally dilute hydrochloric acid. The combined acid solutions were extracted with chloroform, made alkaline with ammonia, and exhausted of alkaloid with chloroform. The chloroform solution was extracted with 2% acetic acid solution, giving an almost colourless extract. This was again basified with ammonia and yielded to chloroform, after drying, a brown, very viscous oil which partly crystallised on standing. Recrystallisation from acetone or preferably ethyl acetate formed large plates of constant m. p. 197—198° (Found: C, 62.4, 62.5, 62.6; H, 7.4, 7.4, 7.2; N, 4.1.  $C_{18}H_{25}O_6N$  requires C, 61.6; H, 7.1; N, 4.0%);  $[\alpha]_D^{25} -6.2^\circ$  ( $l = 0.25$ ;  $c, 1.91$  in chloroform).

The residue from which the crystalline alkaloid had separated was converted into the solid picrate, which was repeatedly purified, and the free base regenerated with lithium hydroxide by Burger's method (*J. Amer. Chem. Soc.*, 1945, **67**, 1615). Only the above base was isolated, and there was no evidence for the presence of other bases. The total yield from both processes was 550 mg., or 0.02% of the dry bark. By a similar procedure *senkirkine* was isolated from the leaves.

The *picrate*, formed from the base (22 mg.) and picric acid (70 mg.) in aqueous solution, recrystallised from water in elongated plates, m. p. 225.5—226° (Found: C, 51.2; H, 4.9; N, 9.7.  $C_{18}H_{25}O_6N, C_6H_3O_7N_3$  requires C, 49.7; H, 4.9; N, 9.7%). The *picrolonate*, formed by the addition of picrolonic acid (16 mg.) in alcohol to the base (20 mg.) in water, recrystallised from 50% alcohol in clustered needles, m. p. 109—110° (shrinking at 106°) (Found: C, 54.1; H, 6.1; N, 12.2.  $C_{18}H_{25}O_6N, C_{10}H_8O_5N_4$  requires C, 54.6; H, 5.4; N, 11.4%).

*Hydrolysis of Senkirkine*.—A solution of the base (520 mg.) in 2N-baryta (10 c.c.) was gently boiled under reflux for one hour (whereupon rapid darkening occurred), cooled, saturated with carbon dioxide, and the barium carbonate filtered off. The solution was acidified to Congo-red with hydrochloric acid and exhaustively extracted with ether in a continuous apparatus. After drying and removal of the ether, the residual, partly solid oil was repeatedly crystallised from ethyl acetate, forming long colourless needles, m. p. 157—158°, yield 50 mg. (Found: C, 60.8; H, 7.0. Calc. for  $C_{16}H_{14}O_4$ : C, 60.6; H, 7.1%). Direct titration (with phenolphthalein as indicator) showed it to be a monobasic acid (equiv., 203. Calc. for  $C_{16}H_{14}O_4$ : equiv., 198), but by the further action of sodium hydroxide solution at 100° followed by back titration with acid the presence of a second potential acid, *e.g.*, lactone group, was indicated. The acid solution on evaporation furnished the original compound. The formula, m. p. [Richardson and Warren (*J.*, 1943, 452) record m. p. 156° (corr.)], crystalline shape, solubilities, and chemical properties all agree with those of senecic acid lactone, with which we consider it is identical.

*The Necine*.—The aqueous solution from the hydrolysis, which gave copious precipitates with alkaloidal reagents, was evaporated to a small volume in a desiccator. An aliquot portion was converted into the picrate, which could not be crystallised from alcohol, acetone, or aqueous alcohol but separated from hot water as an amorphous solid, m. p. 175—180° (decomp.). The free base was regenerated from the purified picrate by Burger's method but separated only as an oil, very soluble in water and extracted therefrom only with difficulty by chloroform. On addition of auric chloride solution to another aliquot portion of the necine, an aurichloride separated in amorphous form (decomp. 165—166°), which, however, could not be crystallised.

The analyses are by Drs. Weiler and Strauss, Oxford, and Mr. J. Mills, University of Adelaide.

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