

## Studies on *Orchidaceae* Alkaloids I

### Screening of species for Alkaloids I

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525 Orchid species have been screened for their alkaloid content. Among these, 77 species have been shown to contain more than 0.01 %, and 21 species more than 0.1 % alkaloids calculated on an estimated "dry weight".

Up to now only two alkaloids have been isolated from orchids. These alkaloids were found in *Dendrobium nobile* Lindl., and were given the names dendrobine and nobiline. Dendrobine was first isolated by Suzuki *et al.*<sup>1,2</sup> who also made an attempt to elucidate its structure. Recently Yamamura and Hirata<sup>3</sup> succeeded in determining the structures of dendrobine and the previously unknown alkaloid nobiline. Further 24 orchid species have been shown to contain traces or larger amounts of alkaloids.<sup>1,4-7</sup> Different methods have been used in demonstrating the alkaloid content in these orchids and in many cases dried plant material has been used. The orchid alkaloids hitherto isolated\* are all very sensitive to oxidation and hydrolysis. Thus, it seemed desirable to use a uniform mild method of analysis. A screening of the alkaloid content in *Orchidaceae* was started, using only living plant material, and preferentially plants grown in their natural habitats. The alkaloid analyses were performed according to the method of Abisch and Reichstein<sup>8</sup> with some minor improvements which appear in the experimental section. The results of the alkaloid analyses of 525 orchid species are found in Table 1.

#### EXPERIMENTAL

*Determination of the alkaloid content of a species.* The fresh plant (10–20 g) was minced with 200 ml of methanol and the mixture was left to stand for at least 24 h at 2°C\*\*. The

\* The author has isolated nine alkaloids from orchids except for dendrobine; the isolation and structural determination of these will be published later.

\*\* All procedures were made under argon.

Table 1. Results of the alkaloid analyses of orchid species.

Species	Alkaloid content <sup>b</sup>	Species	Alkaloid content <sup>b</sup>
<i>Acacallis cyanae</i> Lindl.	++	<i>Brassavola glauca</i> Lindl.	+
<i>Acampe longifolia</i> Lindl.	+	» <i>tuberculata</i> Hook.	++
<i>Acanthephippium striatum</i> Lindl.	+	<i>Brassia angusta</i> Lindl.	+
<i>Aerides affine</i> Wall.	+	» <i>chloroleuca</i> Barb.	—
» <i>crassifolium</i> Rehb.f.	+	Rodr.	—
» <i>crispum</i> Lindl.	+	» <i>lawrenceana</i> Lindl.	—
» <i>falcatum</i> Lindl.	+	» <i>verrucosa</i> Batem.	—
» <i>fieldingii</i> Lodd.	—	<i>Bulbophyllum cauliflorum</i>	
» <i>flabellatum</i> Rolfe.	+	Hook.f.	—
» <i>lawrenceae</i> Rehb.f.	+	» <i>gamblei</i> Hook.f.	(+)
» <i>longicornu</i> Hook.f.	+	» <i>leopardinum</i>	
» <i>mitratum</i> Rehb.f.	+	Lindl.	+
» <i>multiflorum</i> Roxb.	(+)	» <i>viridiflorum</i>	
» <i>odoratum</i> Lour.	(+)	Schltr	—
» <i>vandarum</i> Rehb.f.	+	» <i>watsonianum</i>	
<i>Agrostophyllum brevipes</i> K.		Rehb.f.	+
et P.	—	<i>Calanthe alismaefolia</i> Lindl.	++
» <i>khasianum</i>		» <i>alpina</i> Hook.f.	+
Griff.	—	» <i>biloba</i> Lindl.	+
» <i>myrianthum</i>		» <i>brevicornu</i> Lindl.	+(+)
K. et P.	+	» <i>cardioglossa</i> Schltr.	+(+)
<i>Amblostroma tridactylum</i>		» <i>chloroleuca</i> Lindl.	+(+)
Rehb.f.	++	» <i>densiflora</i> Lindl.	+(+)
<i>Anacamptis pyramidalis</i>		» <i>gracilis</i> Lindl.	++
L.C. Rich.	—	» <i>plantaginea</i> Lindl.	++
<i>Angraecum falcatum</i> Lindl.	++ +	» <i>puberula</i> Lindl.	+
<i>Anoetochilus elwesii</i> K. et P.	—	» <i>vestita</i> Lindl.	+
» <i>grandiflorus</i>		<i>Camaridium imbricatum</i>	
Lindl.	+	Hoehne.	+
» <i>sikkimensis</i>		<i>Camarotis mannii</i> K. et P.	+
K. et P.	+	» <i>obtusa</i> Lindl.	—
<i>Arachnanthe clarkei</i> Rolfe.	+	<i>Camphylacentrum ornithor-</i>	
<i>Arachnis moschifera</i> Blume	+	<i>rhyncum</i> Rolfe.	+
<i>Armorum siamense</i> Schltr.	+	<i>Capanemia thersasiae</i> Barb.	
<i>Arpophyllum giganteum</i>		Rodr.	—
Lindl.	—	» <i>uliginosa</i> Barb.	
<i>Aspasia lunata</i> Lindl.	—	Rodr.	—
<i>Barbosella australis</i> Schltr.	—	<i>Catasetum barbatum</i> Lindl.	++
<i>Batemannia colleyi</i> Lindl.	—	» <i>fimbriatum</i> Lindl.	—
<i>Bifrenaria aureofulva</i> Lindl.	—	» <i>gnomus</i> Lind. et	
» <i>calcarata</i> Barb.		Rehb.f.	+++
Rodr.	+	» <i>macrocarpum</i>	
» <i>harrisoniae</i>		L.C. Rich.	(+)
Rehb.f.	+	<i>Cattleya aelandiae</i> Lindl.	—
» <i>inodora</i> Lindl.	+	» <i>amethystoglossa</i>	
» <i>tetragona</i> Schltr.	+	Lind. et Rehb.f.	+
» <i>tyrianthina</i>		» <i>auranthiaca</i> P. N.	
Rehb.f.	—	Don.	(+)
» <i>vitellina</i> Lindl. <sup>a</sup>	+	» <i>bicolor</i> Lindl.	(+)
<i>Bletilla striata</i> Rehb.f.	—	» <i>bowringiana</i> Veitch.	+
<i>Brassavola cucullata</i> R.Br.	+	» <i>citrina</i> Lindl.	—
» <i>digbyana</i> Lindl.	—	» <i>deckeri</i> Kl.	—
		» <i>dolosa</i> Rehb.f.	—

Species	Alkaloid content <sup>b</sup>
<i>Cattleya dormiana</i> Rehb.f.	(+)
» <i>dowiana</i> Batem.	+
» <i>eldorado</i> Lindl.	(+)
» <i>elongata</i> Barb.Rodr.	++
» <i>forbesii</i> Lindl.	+
» <i>gaskelliana</i> Rehb.f.	+
» <i>granulosa</i> Lindl.	-
» <i>grossii</i> Kränzl.	-
» <i>guttata</i> Lindl.	(+)
» <i>harrisoniae</i> Rehb.f.	-
» <i>intermedia</i> Graham.	+
» <i>labiata</i> Lindl.	++
» <i>lawrenceana</i> Rehb.f.	(+)
» <i>loddigesii</i> Rehb.f.	(+)
» <i>lueddemanniana</i> Rehb.f.	-
» <i>luteola</i> Lindl.	+
» <i>nobilior</i> Rehb.f.	-
» <i>schilleriana</i> Rehb.f.	-
» <i>skinneri</i> Batem.	+
» <i> trianaei</i> Lindl. et Rehb.f.	(+)
» <i>velutina</i> Rehb.f.	+
» <i>walkeriana</i> Gard.	+
» <i>warneri</i> Moore.	++
<i>Cephalanthera longifolia</i> Fritsch.	+
<i>Chysis aurea</i> Lindl.	++
» <i>bractescens</i> Lindl.	+++
<i>Cirrhaea dependens</i> Rehb.f.	-
» <i>obtusata</i> Lindl. var.	-
» <i>pallida</i> Stein.	-
» <i>saccata</i> Lindl.	+
<i>Cirrhopetalum picturatum</i> Lindl.	-
» <i>thouarsii</i> Lindl.	+
<i>Cleisostoma spicatum</i> Lindl.	+
<i>Coelogyne barbata</i> Griff.	(+)
» <i>cristata</i> Lindl.	-
» <i>elata</i> Lindl.	-
» <i>flavida</i> Wall.	-
» <i>longipes</i> Lindl.	-
» <i>nervosa</i> A. Rich.	+
» <i>nitida</i> Hook.f.	-
» <i>ovalis</i> Lindl.	-
» <i>virescens</i> Rolfe.	-
<i>Corallorhiza trifida</i> Chât.	+
<i>Coryanthes maculata</i> Hook.	+
<i>Cremastra wallichiana</i> Lindl.	-
<i>Cynoches pentadactylon</i> Lindl.	+
<i>Cymbidium affine</i> Warn.	(+)
» <i>aloifolium</i> Sw.	+
» <i>cochleare</i> Lindl.	+

Species	Alkaloid content <sup>b</sup>
<i>Cymbidium cyperifolium</i> Wall.	+
» <i>devonianum</i> Paxt.	+
» <i>eburneum</i> Lindl.	(+)
» <i>elegans</i> Lindl.	+
» <i>ensifolium</i> Sw.	+
» <i>finlaysonianum</i> Lindl.	(+)
» <i>giganteum</i> Wall	+
» <i>grandiflorum</i> Griff.	+
» <i>lanceifolium</i> Hook.	+
» <i>longifolium</i> D. Don.	-
» <i>munroianum</i> K et P.	+
» <i>pendulum</i> Sw.	-
» <i>sinense</i> Willd.	-
» <i>simonsianum</i> K. et P.	+
» <i>tigrinum</i> Par.	+
» <i>traceyanum</i> Rolfe.	(+)
» <i>virescens</i> Lindl.	++
<i>Cypripedium cordigerum</i> D.Don.	++
<i>Cyrtopodium andersonii</i> R. Br.	+(+)
» <i>palmifrons</i> Rehb.f. et Warm.	++
» <i>punctatum</i> Lindl.	+
<i>Dendrobium acinaciforme</i> Roxb.	+
» <i>aduncum</i> Wall.	++
» <i>aggregatum</i> var. <i>jenkinsii</i> Lindl.	+
» <i>amoenum</i> Wall.	+
» <i>candidum</i> Wall.	+
» <i>capillipes</i> Rehb.f.	+
» <i>chrysanthum</i> Wall.	+++
» <i>chrysoglossum</i> Schltr.	+
» <i>chrysoxum</i> Lindl.	+
» <i>crepidatum</i> Lindl.	+++
» <i>cretaceum</i> Lindl.	+
» <i>crumenatum</i> Sw.	+

Species	Alkaloid content <sup>b</sup>	Species	Alkaloid content <sup>b</sup>
<i>Dendrobium cumulatum</i> Lindl.	+	<i>Dendrobium sulcatum</i> Lindl.	+
» <i>dalhousianum</i> Wall.	—	» <i>superbum</i> Rehb.f.	+++
» <i>densiflorum</i> Wall.	+	» <i>terminale</i> Par. et. Rehb.f.	++
» <i>devonianum</i> Paxt.	—	» <i>thyrsiflorum</i> Rehb.f.	+
» <i>dixanthum</i> Rehb.f.	+	» <i>tortile</i> Lindl.	++
» <i>draconis</i> Rehb.f.	(+)	» <i>tosaense</i> Makino.	(+)
» <i>falconeri</i> Hook.	+	» <i>transparentis</i> Wall.	+
» <i>farmeri</i> Paxt.	+	» <i>williamsonii</i> Day et Rehb.f.	+
» <i>fimbriatum</i> Hook.	+	<i>Dendrochilum cobbianum</i> Rehb.f.	—
» <i>formosum</i> Roxb.	+	<i>Diacrium bicornutum</i> Benth.	++
» <i>friedricksianum</i> Rehb.f.	++	<i>Dichaea australis</i> Cogn.	++
» <i>gibsonii</i> Lindl.	+	» <i>cogniauxiana</i> Schltr.	+
» <i>griffithianum</i> Lindl.	+	» <i>pendula</i> Cogn.	+
» <i>hercoglossum</i> Rehb.f.	+	<i>Dimerandra emarginata</i> Hoehne	—
» <i>heterocarpum</i> Lindl.	+	<i>Elleanthus brasiliensis</i> Rehb.f.	+++
» <i>hildebrandii</i> Rolfe	++	» <i>linifolius</i> Presl.	+
» <i>hookerianum</i> Lindl.	+	<i>Epidendrum allemannii</i> Barb. Rodr.	—
» <i>infundibulum</i> Lindl.	+	» <i>ansiferum</i> Rehb.f.	+
» <i>kingianum</i> Bidw.	+	» <i>armeniicum</i> Lindl.	+++
» <i>leonis</i> Rehb.f.	+	» <i>atropurpureum</i> Willd.	—
» <i>lituiflorum</i> Lindl.	+	» <i>bracteatum</i> Barb. Rodr.	+
» <i>monile</i> Kränzl.	(+)	» <i>brassavolae</i> Rehb.f.	—
» <i>moschatum</i> Sw.	+	» <i>caldense</i> Barb. Rodr.	—
» <i>nobile</i> Lindl.	+++	» <i>ciliare</i> L.	+
» <i>ochreatum</i> Lindl.	+++	» <i>cinnabarium</i> Lindl.	+
» <i>palpebrae</i> Lindl.	(+)	» <i>cochleatum</i> L.	+
» <i>parishii</i> Rehb.f.	+++	» <i>dichromum</i> Lindl.	+(+)
» <i>pierardii</i> Roxb.	++	» <i>difforme</i> Jacq.	(+)
» <i>primulinum</i> Lindl.	+++	» <i>ellipticum</i> Graham.	+++
» <i>ramosum</i> Lindl.	+	» <i>eximium</i> L.O. Williams	—
» <i>revolutum</i> Lindl.	+	» <i>falcatum</i> Lindl.	++
» <i>secundum</i> Lindl.	+	» <i>faustum</i> Rehb.f.	—
» <i>speciosum</i> Smith	+	» <i>floribundum</i> Kunth.	—

Species	Alkaloid content <sup>b</sup>	Species	Alkaloid content <sup>b</sup>
<i>Epidendrum fragrans</i> Sw.	—	<i>Gomeza crispa</i> Kl. et Rehb.f.	(+)
» <i>glumaceum</i> Lindl.	—	» <i>glaziovii</i> Cogn.	—
» <i>ibaguense</i> H.B.K.	+	» <i>planifolia</i> Kl. et Rehb.f.	—
» <i>imatophyllum</i> Lindl.	+	» <i>recurva</i> R. Br.	—
» <i>longifolium</i> Barb. Rodr.	+	<i>Gongora bufonia</i> Lindl.	+
» <i>mariae</i> Ames	—	» <i>galeata</i> Rehb.f.	+
» <i>mosenii</i> Rehb.f.	++	» <i>minax</i> Rehb.f.	+
» <i>nemorale</i> Lindl.	—	» <i>quinquenervis</i> Ruiz et Pav.	+
» <i>nocturnum</i> Jacq.	—	<i>Goodyera hemesleyana</i> K. et P.	++
» <i>oncidioides</i> Lindl.	—	» <i>procera</i> Hook.	+
» <i>osmanthum</i> Barb. Rodr.	—	» <i>repens</i> R.Br.	++
» <i>patens</i> Sw.	++	» <i>secundiflora</i> Griff.	++
» <i>pseudavicula</i> Kränzl.	++	» <i>vittata</i> Benth.	—
» <i>radiatum</i> Lindl.	—	<i>Grobya amherstiae</i> Lindl.	—
» <i>rigidum</i> Jacq.	+	» <i>galeata</i> Lindl.	++
» <i>stamfordianum</i> Batem.	+	<i>Gymnadenia conopsea</i> R.Br.	—
» <i>varicosum</i> Batem.	—	<i>Herminium monorchis</i> R.Br.	—
» <i>variegatum</i> Hook.	+	<i>Hexisea bidentata</i> Lindl.	++
» <i>vesicatum</i> Lindl.	+	<i>Hormidium tripterum</i> Cogn.	—
» <i>virgatum</i> Lindl.	—	<i>Houletia brocklehurstiana</i> Lindl.	—
» <i>vitellinum</i> Lindl.	—	» <i>juruenis</i> Hoehne	+
» <i>widgrenii</i> Lindl.	—	<i>Huntleya meleagris</i> Lindl.	+
» <i>xanthinum</i> Lindl.	+	<i>Ione paleacea</i> Lindl.	—
<i>Epipactis atrorubens</i> Schult.	+	<i>Ionopsis paniculata</i> Lindl.	—
» <i>helleborine</i> Cr.	++	<i>Isochilus linearis</i> R.Br.	—
» <i>palustris</i> Cr.	++	<i>Jacquinilla globosa</i> Schltr.	—
<i>Eria albedo-tomentosa</i> Lindl.	+	<i>Laelia albida</i> Batem.	—
» <i>carinata</i> Gibs.	+	» <i>anceps</i> Lindl.	—
» <i>coronaria</i> Rehb.f.	+(+)	» <i>autumnalis</i> Lindl.	—
» <i>globifera</i> Rolfe.	+	» <i>cinnabarina</i> Batem.	+
» <i>pannea</i> Lindl.	(+)	» <i>crispa</i> Rehb.f.	+(+)
» <i>stricta</i> Lindl.	+	» <i>flava</i> Lindl.	+
<i>Eulophia nuda</i> Lindl.	—	» <i>furfuracea</i> Lindl.	—
» <i>sanguinea</i> Hook.f.	—	» <i>gloedeniana</i> Hoehne	++
<i>Eulophidium maculatum</i> Pfitz.	—	» <i>gouldiana</i> Rehb.f.	—
<i>Galeandra devoniana</i> Schomb. ex Lindl.	+++	» <i>grandis</i> Lindl.	+
» <i>lacustris</i> Barb. Rodr.	++	» <i>harpophylla</i> Rehb.f.	+
		» <i>johniana</i> Schltr.	—
		» <i>lobata</i> Veitch.	+
		» <i>longipes</i> Rehb.f.	—
		» <i>lundii</i> Rehb.f. et Warm.	—
		» <i>majalis</i> Lindl.	—
		» <i>perrinii</i> Lindl.	—
		» <i>pumila</i> Rehb.f.	+
		» <i>purpurata</i> Lindl.	—
		» <i>rubescens</i> Lindl.	(+)
		» <i>rupestris</i> Lindl.	—
		» <i>superbiens</i> Lindl.	+
		» <i>tenebrosa</i> Rolfe.	—
		» <i>xanthina</i> Lindl.	—

Species	Alkaloid content <sup>b</sup>	Species	Alkaloid content <sup>b</sup>
<i>Lanium avicula</i> Benth.	—	<i>Odontoglossum cordatum</i>	
<i>Leptotes bicolor</i> Lindl.	—	Lindl.	—
<i>Liparis loeselii</i> L.C.Rich.	+++	» <i>cervantesii</i>	+
» <i>longipes</i> Lindl.	+	LLave et Lex	
» <i>mannii</i> Rehb.f.	+	<i>citrosimum</i>	—
<i>Listera ovata</i> R. Br.	+	Lindl.	—
<i>Luisia trichorrhiza</i> Bl.	+	» <i>insleayi</i>	—
<i>Lycaste aromatica</i> Lindl.	—	Lindl.	—
» <i>cruenta</i> Lindl.	—	» <i>laeve</i> Lindl.	—
» <i>deppei</i> Lindl.	—	» <i>pulchellum</i>	
<i>Masdevallia</i> sp. (Mexico)	—	Batem.	++
<i>Maxillaria chrysantha</i> Barb.		» <i>rossii</i> Lindl.	—
Rodr.	—	<i>Oncidium barbatum</i> Lindl.	—
» <i>desvauxiana</i>		» <i>bifolium</i> Sims.	(+)
Rehb.f.	—	» <i>brunlesianum</i>	
» <i>lindleyana</i>		Rehb.f.	+
Schltr.	—	» <i>cavendishianum</i>	
» <i>marginata</i> Fenzl.	—	Batem.	(+)
» <i>picta</i> Hook.	—	» <i>cebolleta</i> Sw.	(+)
» <i>porphyrostele</i>		» <i>concolor</i> Hook.	(+)
Rehb.f.	—	» <i>cornigerum</i> Lindl.	—
» <i>serotina</i> Regn. et		» <i>crispum</i> Lodd.	+
Barb. Rodr.	+	» <i>divaricatum</i> Lindl.	—
» sp. (Mexico)	—	» <i>echinatum</i> Cogn.	—
» <i>vitelliniflora</i> Barb.		» <i>flexuosum</i> Sims.	—
Rodr.	++	» <i>harrisonianum</i>	
<i>Miltonia candida</i> Lindl.	—	Lindl.	—
» <i>clowesii</i> Lindl.	+	» <i>hastatum</i> Lindl.	—
» <i>cuneata</i> Lindl.	—	» <i>incurvum</i> Lindl.	—
» <i>flavescens</i> Lindl.	+	» <i>leucochilum</i>	
» <i>regnellii</i> Rehb.f.	+	Batem.	—
» <i>russeliana</i> Lindl.	—	» <i>liebmannii</i> Kränzl.	—
» <i>spectabilis</i> Lindl.	—	» <i>lietzei</i> Rgl.	+
<i>Mormodes hookerii</i> Lemaire	+	» <i>longicornu</i> Mutel.	+
» <i>maculatum</i> var.		» <i>longipes</i> Lindl.	+
<i>unicolor</i> L.O.		» <i>maculatum</i> Lindl.	—
Williams	++	» <i>ornithorrhyncum</i>	
<i>Neolauchia pulchella</i> Kränzl.	+	H.B.K.	+(+)
<i>Neottia nidus avis</i> L.C.Rich.	++	» <i>pubes</i> Lindl.	—
<i>Nephelaphyllum pulchrum</i>		» <i>pumilum</i> Lindl.	+
Blume.	++	» <i>raniferum</i> Lindl.	—
<i>Notylia lyrata</i> Sp.Moore.	—	» <i>robustissimum</i>	
<i>Oberonia ensiformis</i> Lindl.	+	Rehb.f.	+
» <i>myriantha</i> Lindl.	+	» <i>sarcodes</i> Lindl.	—
<i>Octomeria crassifolia</i> Lindl.	+	» <i>sphacelatum</i>	
» <i>gracilis</i> Lodd.	(+)	Lindl.	+
» <i>grandiflora</i> Lindl.	+	» <i>sphegiferum</i>	
» <i>juncifolia</i> Barb.		Lindl.	(+)
Rodr.	+	» <i>stramineum</i>	
» <i>praestans</i> Barb.		Batem.	+(+)
Rodr.	—	» <i>wentworthianum</i>	
» <i>ruthiana</i> Hoehne.	+	Batem.	—
<i>Odontoglossum bictoniense</i>		» <i>widgrenii</i> Lindl.	(+)
Lindl.	+	<i>Ophrys insectifera</i> L.	+

Species	Alkaloid content <sup>b</sup>	Species	Alkaloid content <sup>b</sup>
<i>Orchis incarnata</i> L. ( <i>Dactylorchis</i> Verm.)	—	<i>Phloeophila paulensis</i> Hoehne et Schltr.	+
» <i>maculata</i> L. ( <i>Dactylorchis</i> Verm.)	—	<i>Pholidota recurva</i> Lindl.	—
» <i>mascula</i> L.	—	» <i>rubra</i> Lindl.	—
» <i>militaris</i> L.	—	<i>Phymatidium falcifolium</i> Lindl.	—
» <i>morio</i> L.	—	<i>Physosiphon pubescens</i> Barb. Rodr.	++
» <i>ustulata</i> L.	—	<i>Platanthera bifolia</i> L.C. Rich.	+
<i>Ornithocephalus reitzii</i> Pabst.	(+)	<i>Platyclinis glutinosa</i> Benth.	(+)
<i>Paphiopedilum barbatum</i> Pfitz.	—	<i>Pleurobotrium hatschbachii</i> Hoehne	(+)
» <i>bellatulum</i> Pfitz.	+	<i>Pleurothallis arcuata</i> Lindl.	+(+)
» <i>callosum</i> Pfitz.	—	» <i>grobii</i> Lindl.	+
» <i>concolor</i> Pfitz.	(+)	» <i>josephensis</i> Barb. Rodr.	++
» <i>exul</i> Pfitz.	—	» <i>linearifolia</i> Cogn.	—
» <i>faireanum</i> Pfitz.	—	» <i>mattinhensis</i> Hoehne.	—
» <i>godefroyae</i> Pfitz.	—	» <i>oligantha</i> Barb. Rodr.	++
» <i>hirsutissimum</i> Pfitz.	—	» <i>peduncularis</i> Lindl.	+
» <i>insigne</i> Pfitz.	+++	» <i>saundersiana</i> Rehb.f.	++
» <i>javanicum</i> Pfitz.	+	» <i>saurocephala</i> Lodd.	+
» <i>niveum</i> Pfitz.	—	» <i>sonderana</i> Rehb.f.	+
» <i>parishii</i> Pfitz.	—	» <i>spiralis</i> Lindl.	—
» <i>venustum</i> Pfitz.	+	» <i>trialata</i> Cogn.	++
» <i>villosum</i> Pfitz.	+	<i>Polystachya estrellensis</i> Rehb.f.	+
<i>Paradisianthus micranthus</i> Schltr.	+	<i>Promenaea stapelioides</i> Lindl.	+
<i>Peristeria elata</i> Hook.	++	<i>Reichenbachanthus reflexus</i> C. Porto et Brade.	+
<i>Phalaenopsis amabilis</i> Bl.	+++	<i>Renanthera coccinea</i> Lour.	(+)
» <i>buyssonianana</i> Rehb.f.	+++	<i>Rhyncostylis retusa</i> Bl.	+
» <i>cornu-cervi</i> Rehb.f.	++	<i>Rodriguezia decora</i> Rehb.f.	(+)
» <i>esmeralda</i> Rehb.f.	+++	» <i>fragrans</i> Rehb.f.	—
» <i>mannii</i> Rehb.f.	+++	» <i>pubescens</i> Rehb.f.	+
» <i>parishii</i> Rehb.f.	+++	» <i>secunda</i> Kunth.	—
» <i>serpentilingua</i> J.J. Smith	+	» <i>venusta</i> Rehb.f.	+
» <i>violacea</i> Teijsm. et Binn.	++	<i>Rodriguezopsis eleuterosepala</i>	+
		<i>Rudolphiella aurantiaca</i> Hoehne	++
		<i>Saccolabium ampullaceum</i> Lindl.	(+)
		» <i>curviflorum</i> Lindl.	+
		» <i>dasyogon</i> Lindl.	(+)

Species	Alkaloid content <sup>b</sup>	Species	Alkaloid content <sup>b</sup>
<i>Saccolabium distichum</i> Lindl.	+ (+)	<i>Stelis ruprechtiana</i> Rehb.f.	+
» <i>giganteum</i> Lindl.	++	<i>Stenocoryne melanopoda</i> Hoehne	++
» <i>miniatum</i> Lindl.	+	» <i>vitellina</i> Kränzl. <sup>a</sup>	+
<i>Sarcanthus insectifer</i> Rehb.f.	+	<i>Stereochilus hirtus</i> Lindll	-
<i>Sarcopodium amplum</i> Lindl.	+	<i>Tetragamestus modestus</i> Rehb.f.	+
» <i>fuscescens</i> Lindl.	+	<i>Theodorea gomezoides</i> Barb. Rodr.	++
» <i>rotundatum</i> Lindl.	+	<i>Thunia marshalliana</i> Rehb.f.	+
<i>Schomburgkia crispa</i> Lindl.	-	<i>Trichocentrum albo-coccineum</i> Lindl.	+
» <i>amazonica</i> Pabst	+	» <i>fuscum</i> Lindl.	++
<i>Scuticaria hadwenii</i> Planch.	+	<i>Trigonidium latifolium</i> Lindl.	-
» <i>steelii</i> Lindl.	+	» <i>obtusum</i> Lindl.	(+)
<i>Sigmatostalix radicans</i> Rehb.f.	-	<i>Vanda batemanni</i> Lindl.	++
<i>Sobralia macrantha</i> Lindl.	+	» <i>coerulea</i> Lindl.	-
» <i>violacea</i> Lindl. et Lindl.	+	» <i>coerulescens</i> Griff.	+
<i>Sophranitis cernua</i> Lindl.	-	» <i>denisoniana</i> Bens. et Rehb.f.	+
» <i>coccinea</i> Rehb.f.	-	» <i>insignis</i> Bl.	+(+)
» <i>pterocarpum</i> Lindl.	-	» <i>lowii</i> Lindl.	+
» <i>rosea</i> hort.	+	» <i>parishii</i> Rehb.f.	+
» <i>violacea</i> Lindl.	+	» <i>roxburgii</i> K. Br.	+
<i>Spathoglottis affinis</i> De Vries.	-	» <i>stangeana</i> Rehb.f.	(+)
» <i>plicata</i> Bl.	+	» <i>teres</i> Lindl.	+
<i>Spiranthes</i> sp.	+	» <i>tricolor</i> Lindl.	+
<i>Stanhopea candida</i> Barb. Rodr.	+	<i>Vandopsis gigantea</i> Pfitz.	++
» <i>eburnea</i> Lindl.	+	<i>Warrea tricolor</i> Lindl.	+
» <i>graveolens</i> Lindl.	+	<i>Warscewiczella flabelliformis</i> Cogn.	++
» <i>guttulata</i> Lindl.	+	» <i>walesiana</i> Rehb.f.	+(+)
» <i>insignis</i> Frost.	+	<i>Xylobium brachystachyum</i> Kränzl.	++
» <i>tigrina</i> Batem.	+(+)	» <i>squalens</i> Lindl.	+
» <i>wardii</i> Lodd. ex Lindl.	-	<i>Zygopetalum brachypetalum</i> Lindl.	+
<i>Stauropsis fasciata</i> Benth.	-	» <i>crinitum</i> Lodd	+
<i>Stelis porschiana</i> Schltr.	-	<i>Zygostates lunata</i> Lindl.	-
» <i>reitzii</i> Garay	-		

<sup>a</sup>) *Bifrenaria vitellina* Lindl. and *Stenocoryne vitellina* Kränzl. are identical according to Hoehne.<sup>10</sup> Non-identical plants bearing the two names have been investigated, and the names used will be treated as correct until further evidence.

<sup>b</sup>) The signs given in this column are explained in the text, p. 1515.

slurry was heated to boiling for 10 sec, filtered and evaporated to dryness *in vacuo*. The residue was extracted with 2 × 10 ml of 0.5 N HCl and the acidic aqueous solution filtered. Sodium acetate (1 g) was added and the pH-value adjusted to 8.5 by the addition of sodium hydroxide. The solution was then extracted with 3 × 20 ml of a mixture of chloroform and ethanol 3:2 (v/v). The chloroform-ethanol solution was



dried over anhydrous sodium sulphate, and evaporated to dryness. The residue was taken up in 0.4 ml of 0.5 N HCl. This solution was tested with the following six reagents\*: *Dragendorff spot test*, *Meyer reagent*, *Hager reagent*, *Wagner reagent*, *Sonnenschein reagent*, and *Silicotungstic acid reagent*. The alkaloid test was considered positive only if the reaction with all six reagents was positive. A rough estimate of the alkaloid concentration in the test solution was obtained by comparison of the extent of the reactions with the Dragendorff and the Meyer reagents with those of a solution of known alkaloid concentration. The alkaloid content in the plant was then calculated on the basis of a "dry weight" which was estimated to be 20 % of the fresh weight. The results are presented in Table 1 where the following signs have been used to represent the alkaloid content:

- below 0.001 %
- (+) approximately 0.001 %
- + between 0.001 % and 0.01 %
- +(+) approximately 0.01 %
- ++ between 0.01 % and 0.1 %
- +++ over 0.1 %

The identification of species has involved a great problem since it was necessary to know whether the names given to the plants were actually correct. A number of territorial orchid floras and monographs on different orchid genera have been used in the identification and naming of species.<sup>9-27</sup>

The plants used in this investigation have been imported from firms in their native countries. The Brazilian species were obtained from Orquideario Catarinense, Corupa; the Middle American species from Orquideas Mexicanas, Mexico City, and Carlos Chavarrio, Costa Rica; the Japanese species from Yoshio Nagano, Tokyo; the New Guinean species from Mrs. H. Chadim, Goroka; the Malayan species from Nam Kee Nurseries, Singapore; the Siamese species from Bangkrabue Nursery Bangkok; and the Indian species from Chandras Orchid House, Kalimpong, and Ghose and Co., Darjeeling. The European species were collected in south Sweden.

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\* Regarding the preparation of these reagents see Ref.<sup>8</sup>

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