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A SURVEY OF THE GENUS HYPOXIS LINN IN THE TRANSVAAL

BY

SELMA COHEN

A SURVEY OF THE GENUS HYPOXIS LINN.

IN THE TRANSVAAL.

BY

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Being a paper presented in part fulfilment of the regulations governing the degree of Master of Science in the University of the Witwatersrand.

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I. INTRODUCTORY NOTE.

In the course of a study of the pre-rain and Spring flora of the Transvaal Highveld, the genus Hypoxis and the many controversies of nomenclature with which it is surrounded, first came to the writer's notice. The large range of forms and the wide ecological and geographical distribution were found to be particularly interesting; accordingly in March, 1938 an intensive study of local members of the genus was commenced. The survey was gradually extended to embrace all species occurring in the Transvaal. Actually most of the material available from South African herbaria has been examined, whatever the geographical distribution, but for the purpose of this paper only the Transvaal forms will be dealt with in detail. Twenty-five species and seven varieties are described in all.

II. DISTRIBUTION OF THE GENUS.

In sharp contrast to the closely related genus Spiloxene, which has restricted itself to the S.W. Cape, Hypoxis has established centres of development in various parts of the world. It is found in tropical Asia, in Indo-Malayan territory, there are two species in Japan and Formosa, and it has spread to America. Here it is represented from Canada, through the United States and Mexico, to Montevideo in tropical South America. The genus is found in northern and central Africa, but attains its maximum development in the South.

The central point of development appears to lie in the eastern Cape. In the vicinity of Uitenhage over half of the known species occur. Hypoxis is also common in Natal and the Transvaal, less common in the O.F.S. and occasional

in Basutoland and Swaziland. It is with the Transvaal species that we are mainly concerned, and the accompanying map illustrates the distribution of Hypoxis in that province. A cross in each district represents one species, and, naturally, no matter how many times the species has been collected from that district, it is only represented by a single symbol. Obviously a map of this sort can only give a very general idea of the distribution, since more collecting has been done in some parts of the country than in others; for example, very intensive collecting was done on the Witwatersrand. At a rough estimate, then, the following is the incidence of species in the Transvaal, the greater number being found on the grasslands of the S.E. parts of the province.

Pretoria dist.	19	species
Witwatersrand Dist.	18	"
Barberton "	14	"
Ermelo "	9	"
Frankenwald area of Pretoria dist.	9	"
Pietersburg dist.	8	"
Lydenburg "	7	"
Middleburg "	6	"
Heidelberg "	6	"
Belfast "	6	"
Carolina "	6	"
Piet Retief "	5	"
Rustenberg "	5	"
Zoutpansberg "	5	"
Krugersdorp "	4	"
Potchefstroom "	4	"
Vereeniging "	4	"
Standerton "	4	"
Ventersdorp "	3	"
Klerksdorp "	2	"
Wakkerstroom "	2	"

MAP ILLUSTRATING DISTRIBUTION

OF HYPOXIS IN THE

TRANSVAAL

BECHUANALAND

ZOUTPANSBERG

PIETERSBURG

PORT. EAST AFRICA

ROOIBERGPOORT

WATERBERG

PILGRIMS REST

RUSTENBURG

LYDENBURG

PRETORIA

MIDDELBURG

MARICO

BARBERTON

WITBANK

VENTERSDORP

KLERKSDORP

POTCHEFSTROOM

HEIDELBERG

STANDERTON

WAKKERSTROOM

O.F.S.

BLOEMHOF

PIET RETIEF

THE ILLUSTRATING DISTRIBUTION

OF AFRICA IN THE

TRANSVAAL

Bethal	dist.	2	species
Witbank	"	2	"
Marico	"	1	"
Waterberg	"	1	"
Potgietersrust	"	1	"
Pilgrim's Rest	"	1	"
Lichtenburg	"	1	"
Wolmaransstad	"	1	"
Bloemhof	"	1	"

III. HISTORY AND AFFINITIES.

The genus Hypoxis was first described by Linnaeus in 1759 (Syst. Ed. X, p. 986). He defined its characters very briefly as "Cor. 6 - partita, stam. breviora, germen infernum." Of the three species which he describes, only the American forms H. erecta L. and H. decumbens L. belong to the genus Hypoxis. At the end of the eighteenth century the first species of Hypoxis (H. villosa Linn.f.) was reported from the Cape. The remaining forms then called Hypoxis are now regarded as species of Spiloxene. Shortly afterwards Lamarck (Encyc. III, 182) added to these another South African species. About twenty years later Burchell recorded the now well-known H. obtusa Burch. from hitherto uninvestigated territory in sub-tropical South Africa (Bot. Reg. t. 159, 1815). Gradually, as the country opened up, more and more species were described (H. Rooperii Moore, H. kraussiana Buch. and H. Ludwigii Bak.), and in 1830 Roemer and Schultes published in the second part of the seventh volume of their "Systema Vegetabilium" a synopsis of the genus Hypoxis. It was not until 1878, however, that a comprehensive systematic investigation was undertaken by Baker (Journ. Linn. Soc. XVII, p. 98). Two years later he worked on Welwitsch's collection from Angola, which threw considerable light on the geographical distribution of

certain species (Trans. Linn. Soc. Ser. II, Bot. I, p. 266, 1880). Finally Baker dealt with all the species of Hypoxis known to him in Flora Capensis VI, 1896, and Flora of Tropical Africa VII, 1898, where he gives a key, and descriptions of all these species. Since the publication of these two volumes, however, a great number of new species have been discovered, and many faults found with the old methods of classification, so that in 1914 Nel published a much-needed monograph on the Amaryllidaceae-Hypoxidae (Engl. Bot. Jahrb. Bd. 51, Heft 3), which will afford a good basis for more detailed investigations in different parts of the country. Even since the appearance of Nel's papers a number of new species of Hypoxis have been published, and a vast amount of work remains to be done before the genus can be put into any sort of systematic order.

In Baker's first classification of 1878 he differentiated four genera in the Hypoxidae:

1. Hypoxis
2. Molineria
3. Curculigo
4. Pauridea, which was later transferred to the family Haemodoraceae. Hypoxis was divided into two subgenera, Ianthe and Euhypoxis.

Bentham and Hooker (Gen. Plant. Vol. III, pars. II, 1883, p. 712) made the following revision of Baker's classification:

1. Hypoxis
   Subgenera: Ianthe
   Euhypoxis
2. Pauridea
3. Curculigo
   Subgenera: Molineria
   Empodium
4. Campynema, which was subsequently transferred by Pax (Naturl. Pflanzenfam. II, 1888, Abt. 5, p.121)

to the sub-family Campynematoideae of the Amaryllidaceae. In all other respects Pax upheld the classification advocated by Bentham and Hooker.

In 1914 Nel did away with all these cumbersome subdivisions, and split the Hypoxidae into six genera:

1. Hypoxis
2. Molineria
3. Forbesia
4. Ianthe
5. Rhodohypoxis
6. Curculigo

The species belonging to Ianthe have since been transferred by Garside to the genus Spiloxene. (Journ. of Bot. LXXIV, Sept. 1936).

In dealing with South African, and particularly Transvaal material, Nel's classification, using as his chief basis of differentiation the method of attachment of the anthers to the filaments, has been found to be extremely satisfactory.

IV. MORPHOLOGY OF HYPOXIS.

I. Subterranean Organs.

The corm is spherical to oblong, and though fairly constant in shape, exhibits a considerable range of size. The corm of H. parvifolia Bak. is ¼" in diameter, while specimens collected on the Witwatersrand of H. Rooperii Moore, for instance, sometimes attains the remarkable diameter of 5 - 6" (See Plate XXII, Fig. a). There is a thin, usually yellow, fleshy, outer portion, while the core, particularly in the larger forms is very compact, fibrous and sometimes almost woody. The corm is crowned at its upper end by the remains of old leaves. These may either take the form of fibres which range from soft, weak hairs to strong and rigid bristles as in H. multiceps Buch., or of thin brown or black

papery membranes as in H. membranacea Bak.

The roots are usually numerous, straight, cylindrical, unbranched and contractile. eg. H. obtusa Burch. They attain great lengths (up to 9"), and range in width from 1/16 - ¼", the thicker roots often being quite fleshy. In some of the smaller forms straight rootlets which are not contractile and are sparsely branched have been observed. (H. filiformis Bak.).

Certain of the very large corms (H. Rooperii Moore, H. obtusa Burch., H. hemerocallidea F. et Mey) were found to exude quantities of reddish-brown, jelly-like substance if the surface were punctured during collecting (See Plate XXI a). Knowing that mucilage frequently occurs in the tubers of the Orchidaceae and the bulbs of other monocotyledons such as Scilla and Allium, it was decided to test this secretion for mucilages. The chief difficulty encountered was that even though it was boiled in water for a considerable time, only a small proportion of the substance dissolved, and, when cooled, it was inclined to precipitate. Accordingly, all tests having shown negative results with the cold liquid, it was decided that a hot solution must be used. Even under these circumstances the results were anomalous. Six tests were made, three of which showed negative results and three positive.

Tests indicating the presence of mucilage.

1) No colour was given with iodine solution.
2) Fehling's solution was not reduced.
3) On being heated with concentrated hydrochloric acid and a little phloroglucinol a faint red colour probably due to the presence of pentoses was produced.

Tests indicating the absence of mucilage.

1) There was no precipitate on the addition of alcohol.
2) On boiling the solution with concentrated hydrochloric acid, aniline acetate paper gave a negative reaction for pentoses.

3) 20 ccs. of the solution were boiled with twice the tne volume of dilute sulphuric acid in a beaker for ten minutes. The solution was cooled and neutralized with sodium hydroxide, but it did not reduce Fehling's solution.

The investigation of this problem is still in progress, and will be continued next spring when the exudate is most abundant. Towards the latter part of the summer work was impeded because an insufficient quantity of material was available. Large amounts are required because of the difficulty entailed in making a concentrated solution.

II. Leaves.

The leaves in Hypoxis exhibit a great range of size, shape, texture, etc. They arise within the sheath of old fibres or tunics, and the number is usually from six to eight, but exceptions do occur, such as H. parvifolia Bak. in which there are three to four leaves, and H. Rooperii Moore, where as many as twenty often develop. The leaf arrangement is never equitant and flattened laterally, as is so common in many related genera. The leaves are sessile and often dilated at the base.

Their shape varies from terete (H. filiformis Bak., H. kraussiana Buch.) to broadly lanceolate (H. digotricha, Bak., H. colchicifolia, Bak.), with many intergrading forms. The leaves of H. angustifolia, Lam. are narrowly linear, while those of H. rigidula, Bak. are broader, but also linear in shape. A linear-lanceolate leaf is the most common (H. acuminata, Bak., H.neliana, Schinz., H. obtusa, Burch., H. costata, Bak.), while the lanceolate form occurs in H. membranacea, Bak., H. parvifolia, Bak., H. villosa, Linn. f., H. multiceps, Buch. etc.

The variation in size is as great as that in shape, H. membranacea Bak., H. neliana Schinz. and H. parvifolia Bak. never reach a greater height than about 5", while H. rigidula Bak. has been observed on the Witwatersrand

with leaves over three feet long. The average length of the leaves at flowering time is from 10 - 12", but many species are found to elongate considerably subsequently. The width varies from terete or subterete (H. longifolia Bak.) to forms like H. latifolia Hook. in which the leaves are never less than 1½" in width, and attain a span of as much as 4" under favourable conditions.

The leaves are of a firm homogeneous construction, and very thin forms are only found in H. membranacea Bak., H. Woodii Bak., and H. Buchanani (sp. nov.). The laminas are very strongly ribbed, the veins ranging from three to over twenty, and being either equally or unequally thickened. Sometimes they are more prominent on one surface than the other, but these characters have been found to vary considerably with the environmental conditions.

The majority of species of Hypoxis have hairy leaves, the only Transvaal forms which have been found to be entirely and constantly glabrous being H. Buchanani, H. colchicifolia Bak., H. oligotricha Bak., H. latifolia Hook., and, according to Nel's description, H. interjecta Nel. The type and degree of hairiness varies considerably between species, and even within the individual species, for example, in the case of H. villosa Bak. some specimens are very densely clothed with hairs, while others are almost glabrous. Sometimes the upper surface of the lamina is thickly hirsute, while the lower surface is glabrous, as in the majority of H. Rooperii Moore. On H. costata Bak. both surfaces are glabrous, while the margins and under surface of the mid-vein are fimbriate. In certain of the hairy forms too, the margins have been found to be fimbriate. The hairiness varies not only in position, but also in size, texture and colour. H. acuminata Bak. is usually very shortly and sparsely hairy, while in H. rigidula var. pilosissima Bak. the hairs are extremely long and dense. In the latter species the hairs are white or grey, in

H. argentea Bak. they are silver, in H. multiceps Buch. gold, and in H. villosa Bak. often a reddish-brown, but hair colouration too is a very variable character. The hairs in H. argentea var. sericea Bak. and H. Gerrardii Bak. are very soft and silky, while in H. rigidula Bak. they are more erect and rough to the touch. On anatomical investigation, the hairs are found to be very simple and unbranched. Occasionally they are stellate as in H. multiceps Buch.

III. Inflorescence.

All members of the genus are acaulescent. The peduncle is always hairy to a greater or lesser degree, and usually approximately the same length as the leaves at the time of flowering. In H. neliana Schinz and H. membranacea Bak., however, it is always longer than the leaves, while in H. latifolia Hook. it is shorter. The bracts are linear to lanceolate, usually hairy, and vary in length from 1 line to 1", and in width from a hair to $\frac{1}{8}$". The inflorescence ranges from corymbose to racemose, with a number of intergrading forms. Nel puts forward the theory that the raceme is the oldest type of inflorescence from which the corymb has developed by a gradual lengthening of the lower petioles. In H. hemerocallidea F. et Mey we have a true raceme with almost sessile flowers, in H. Rooperii Moore the lower pedicels are up to 2" long, while the upper pedicels remain short. In H. villosa Bak. we have a corymb, which is sometimes arched in shape, the outside flowers occurring on a slightly lower level, while in H. argentea Bak. the inflorescence is a true corymb. H. parvifolia has two flowers, usually on the same level, and H. membranacea Bak. would be the most highly developed member of the genus with only one flower. It is doubtful whether Nel has produced sufficient evidence in support of this theory. The inflorescence in Hypoxis presents many anomalies, and more material must be examined before this analysis can be safely criticised.

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