

SUGGESTIONS FOR THE APPLICATION OF EXPERIMENTAL TAXONOMIC TECHNIQUES TO SPECIES INDIGENOUS TO RHODESIA AND NEIGHBOURING TERRITORIES IN AFRICA

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ABSTRACT

With the publication of the *Flora Zambesiaca*, progress in the orthodox taxonomic treatment of species from Rhodesia and neighbouring territories of South Central Africa has reached the stage where a number of problem species have been brought to light which should provide suitable material for more advanced methods of taxonomic research. A number of such species are listed with short notes on each for the benefit of future investigators in this field.

INTRODUCTION

The *Flora Zambesiaca* (Exell *et al.*, 1960-), which deals with the flora of Rhodesia, Malawi, Zambia, Mozambique and Bechuanaland Protectorate, has recently published the first part of its second volume (1963) and has Vol. 2, part 2, in the press. As each volume contains or will contain more than 600 species, it can be said that something in excess of 1200 species or more than 10% of the flowering plants have been dealt with in a reasonably careful orthodox taxonomic manner. In this process some groups have proved more difficult than anticipated and perhaps in some few cases a little easier. However that may be, it seems probable that the various authors of the different families have discovered and consequently revealed in their respective treatments those taxa which are genuinely difficult of definition or segregation by orthodox methods, using in the main characters of more or less superficial morphology.

Although experimental taxonomic research methods, using the most modern techniques of cytology, genetics, palynology, phytochemistry, and numerical plant taxonomy, have so far been more or less confined to European, N. American and some Asiatic taxa, it is felt that the time has been reached, through the publication of various regional floras in Africa, when a beginning could be made in a more advanced treatment of a number of Africa taxa. Furthermore, the growth of new African universities should mean that a proportion of such studies could be carried out in Africa itself. In the following few pages are suggestions based on the experience of the present author, partly in his preparation of various families for the *Flora Zambesiaca*, partly on treatments carried out by other contributors and partly on twenty years field experience in Rhodesia and neighbouring territories.

The writer is very grateful for the opportunity of dedicating these few suggestions to the memory of his old friend Professor Robert E. Woodson, Jr., particu-

larly in view of the latter's own pioneering efforts, in the application of numerical plant taxonomy and studies in hybridity, in his classical study of the North American *Asclepias tuberosa* (1947). Professor Woodson's influence was also more directly concerned since he and the writer carried on for a number of years an unusual exchange system whereby the Government Herbarium, Salisbury, supplied duplicate herbarium material in exchange for microcopies of botanical literature not available in Salisbury. As the shortage of literature is one of the principal difficulties in carrying on taxonomic work in the newer and more isolated herbaria, this exchange played a considerable part in making it possible for work on the Flora Zambesiaca to be carried out in Salisbury as well as in the more metropolitan centres of the British Museum (Natural History), Kew, Coimbra and Lisbon.

A very few studies using more advanced techniques making use of South Central African taxa have already been attempted, among which may be mentioned Tomlinson's (1964) study of the microscopic anatomy of *Triceratella* which aims at the elucidation of the relationship of this genus with its congeners in the *Commelinaceae*. Phipps (1964), having worked out a generic classification of the *Arundinelleae*, is now engaged in cytotaxonomic and numerical investigation in this group, including an investigation of the many species occurring in this area, and recently Professor A. S. Boughey, until lately Professor of Botany in the University of Rhodesia and Nyasaland in Salisbury has begun numerical taxonomic investigations into the variability of leaf shape in *Terminalia sericea* Burch. and the related species with which it may hybridise, *T. trichopoda* Diels and *T. brachystemma* Welw. ex Hiern.

SUGGESTED SPECIES REQUIRING THE APPLICATION OF EXPERIMENTAL TAXONOMIC METHODS

1. *Clematopsis scabiosifolia* (DC.) Hutch., Kew Bull. **1920**: 20(1920).—Exell, Léonard & Milne-Redh., Bull. Soc. Roy. Bot. Belg. **83**: 407 (1951).—Exell & Milne-Redh., Fl. Zamb. **1**, 1: 93(1960).

The difficulties in the treatment of this species are well-known as they have now been referred to in the relatively recent regional floras of Angola, the Congo and East Tropical Africa. Sufficient to say that subspecific taxa are involved which however intergrade and which are defined in the Flora Zambesiaca merely as "groups" in the absence of a firm opinion as to whether the subspecific taxa involved are subspecies, varieties or assemblages of plants incapable of reliable separation at any level. There are some suggestions of incomplete geographical segregation and some groups are certainly extremely divergent from other groups. The problem is complicated by the fact that this perennial often grows in areas subject to annual fires which can produce temporary variation in leaf shape according to how recent or fierce a fire may have been. In addition, it seems likely that several basic species may be involved which hybridise with one another. The necessity for the observation of the various forms under cultivation, breeding experiments and cytological investigations is strongly indicated.

2. *Maerua juncea* Pax in Engl., Bot. Jahrb. **14**: 302(1891).—Wild, Fl. Zamb. **1**, 1: 218(1960).

Subsp. *juncea*.

Subsp. *crustata* (Wild) Wild, tom. cit. 219.

These two species differ somewhat in the shape of their petals but there is an overlap in this character; they can only be separated reliably in fruit since the fruit of subsp. *juncea* is smooth whilst that of subsp. *crustata* is very rough. The minor but clearcut difference between these two taxa may only be due to a difference in a single gene.

3. *Hybanthus enneaspermus* (L.) F. Muell., Fragm. **10**: 81(1876).—Robson, Fl. Zamb. **1**, 1: 254(1960).

Five varieties are considered by Robson to occur in the Flora Zambesiaca area. Three of these, var. *nyassensis* (Engl.) N. Robson, var. *serratus* Engl. and var. *caffer* (Sond.) N. Robson show fairly well defined geographical segregation and would probably be better considered as subspecies. Apart from being widespread in Africa, the species also occurs in Madagascar, Comoro Is., Socotra, Arabia, tropical Asia, Malaysia and Australia. Variable species with inter-continental distributions are obviously worthy of further study. Var. *enneaspermus* shows weedy characteristics in our area and may have been introduced. Such an introduction could obviously have hybridised with indigenous forms and have helped to produce a complicated taxonomic pattern. The cultivation of forms from Africa and elsewhere under comparable conditions and experimental hybridisation is undoubtedly desirable.

4. *Flacourtia indica* (Burm. f.) Merrill, Interpr. Rumph. Herb. Amboin. 377(1917).—Wild, Fl. Zamb. **1**, 1: 286(1960).

A widespread species in Africa and also through Asia to China. This species shows extreme variability in indumentum, leaf-shape and presence or absence of spines. It also varies in habit from a shrub of savanna woodland to a 12 metre tall tree with fierce branching thorns in riverine fringes. A numerical taxonomic approach to leaf-shape and leaf-size might solve this problem of whether one or more species or subspecific taxa are involved.

5. *Scolopia zeyheri* (Nees) Harv. in Harv. & Sond., Fl. Cap. **2**: 584(1862).—Wild, Fl. Zamb. **1**, 1: 276(1960); **1**, 2: 565(1961).

A polymorphic "species" consisting of what may be ecotypes, subspecies or species, which are distributed respectively in submontane evergreen forest, open woodland or coastal bushland. The taxonomic situation is comparable with that of *Flacourtia indica* and numerical taxonomic methods may be of use.

6. *Silene burchellii* Otth. in DC., Prodr. **1**: 374(1824).—Wild, Fl. Zamb. **1**, 2: 352(1961).

Var. *angustifolia* which occurs in the Flora Zambesiaca area and throughout tropical Africa and in Arabia is very variable in itself and very distinct at first sight

from var. *burchellii* which is confined to the South Western and Eastern Cape Province of S. Africa. Whether var. *augustifolia* is merely subspecifically distinct or should be treated as a distinct species is not clear and cytological and plant breeding investigations are desirable.

7. *Psorospermum febrifugum* Spach, Ann. Sci. Nat., Bot., Sér. 2, **5**: 163(1836).—Robson, Fl. Zamb. **1**, 2: 387(1961).

An extremely variable species with a wide distribution in tropical Africa. Some of the variations are mentioned by Robson (loc. cit.) but, in addition, there is an extreme glabrescent form recently collected (*Wild* 6555 (SRGH) from Rhodesia, Melsetter District, Haroni Gorge) which, it is very difficult to believe, after seeing it in the field, is conspecific with the very tomentose forms mentioned by Robson. Numerical taxonomy and cultivation of the various forms might help resolve the problem.

8. *Hibiscus schizopetalus* (Mast.) Hook. f. in Curt., Bot. Mag. t. 6524 (1880).—Exell, Fl. Zamb. **1**, 2: 470(1961).

Although there is evidence referred to by Exell (loc. cit.) that this plant is indigenous (although widely cultivated in Africa) in East Africa its lacinate petals and general appearance strongly suggest that it is a cultivar of *H. rosa-sinensis* L., a native of tropical Asia, which is widely cultivated in Africa and elsewhere. Genetical experiments with *H. schizopetalus* might find the answer to this problem.

9. *Dombeya burgessiae* Gerr. ex Harv. in Harv. & Sond., Fl. Cap. **2**: 590(1862).—Wild, Fl. Zamb. **1**, 2: 522(1961).

In particular, the two forms mentioned by Wild (loc. cit.) corresponding with the type of *D. burgessiae* from Natal, Swaziland and southern Mozambique and with the type of *D. rosea* Bak. f. from the Transvaal northwards to Kenya ought to repay experimental investigation. A numerical taxonomic examination of bract-shape might be a useful starting point.

10. ?*Melhania acuminata* Mast. × *Melhania forbesii* Planch. ex Mast.—Wild, Fl. Zamb. **1**, 2: 533(1961).

A putative hybrid with styles 4-6 mm long (intermediate between *M. acuminata* 7-11 mm long and *M. forbesii* 1-3 mm long). There is evidence (Wild, loc. cit.) that this putative hybrid occurs where the distributions of the two parents overlap or meet. In addition, one group superficially resembles *M. forbesii* (? back-crosses with *M. forbesii*). Others superficially resemble *M. acuminata*. Breeding experiments would effectively test the validity of this hypothesis.

11. *Grewia subspathulata* N. E. Br., Kew Bull. **1909**: 96(1909).—Wild, Fl. Zamb. **1**, 2: 51(1961).

A species morphologically intermediate between *G. bicolor* Juss. and *G. monticola* Sond. with the appearance of hybrid origin. Both these latter species frequently occur together in Southern Africa. Furthermore, as long ago as 1898, Mrs. Lugard, the collector of the types of *G. cordata* N. E. Br. (= *G. monticola*),

G. kwebensis N. E. Br. (= *G. bicolor*), *G. grisea* N. E. Br. (= *G. bicolor*), remarked on the label accompanying the type of *G. cordata* that "every hybrid seemed to exist in the Kwebe Hills (Bechuanaland Protectorate) between this species and *G. bicolor*." More recent collecting, not only in Bechuanaland but through the greater part of the Flora Zambesiaca area, seems to confirm her view. Although these *Grewia* species are woody shrubs and take a few years to grow to maturity, breeding experiments should be attempted.

Also under *Grewia bicolor* (Wild, loc. cit.) and other *Grewia* species it has been noted that the petals usually possess a basal nectary. When this is so the nectary rests against a glabrous basal portion of the androgynophore. In some cases the basal nectaries are absent and when this is so the glabrous basal portion of the androgynophora is also absent. Although the possession or absence of nectaries is almost certainly of no taxonomic significance and is genetically controlled within a single species, it would be interesting to prove this experimentally.

Grewia bicolor may also hybridise with *G. mollis* Juss. (Wild, tom. cit. 50) and *G. micrantha* Boj. (Wild, tom. cit. 54).

12. *Triumfetta tomentosa* Boj. [Hort. Maurit. 43 (1837) nom. nud.] in Bouton, Douz., Rapp. Ann. Maur. 19(1842).—Wild, Fl. Zamb. **1**, 2: 72 (1961).

Distinguished from *T. pilosa* Roth by fruits with straight or slightly curved setae at the apex of the aculei instead of uncinatate setae. This separation is not entirely satisfactory. Both *T. tomentosa* and *T. pilosa* occur as weeds in the Flora Zambesiaca area and elsewhere and *T. pilosa* in particular is very variable with four named varieties in our area. Hybridisation is therefore quite likely. Alternatively, these two species may not be distinct. Cytological investigations and breeding experiments are indicated.

13. *Sparrmannia ricinocarpa* (Eckl. & Zeyh.) Kuntze, Rev. Gen. Pl. **3**, 2: 26(1898).—Weimarck, Svensk. Bot. Tidskr. **27**: 400-413 (1933).—Wild, Fl. Zamb. **1**, 2: 78(1961).

This species was divided into a number of subspecies by Weimarck (loc. cit.) but it has been noted by Wild (loc. cit.) that Nyasaland material is similar morphologically to subsp. *ricinocarpa* supposed by Weimarck to be confined to S. Africa whilst the Rhodesian material fits subsp. *micrantha* (Burret) Weim. which occurs also in Uganda and East Africa. The situation therefore seems somewhat confused and perhaps we are not dealing with true subspecies. The problem would need re-examination by cytological and breeding experiments.

14. *Dichapetalum cymosum* (Hook.) Engl. in Engl. & Prantl, Nat. Pflanzenfam. **3**, 4: 349(1896).—A. R. Torre, Fl. Zamb. **2**, 1: 324.

This plant is a common cause of cattle poisoning on the Kalahari Sands of Rhodesia, Bechuanaland Protectorate, S. W. Africa, the Northern Cape Province and the Transvaal. At one time the poisonous principle was thought to be a cyanogenetic glucocide but it has now been proved to be fluoracetic acid (for a comprehensive review of the toxic action of the plant see Watt and Breyer-

Brandwijk (1962) pp. 375-383). *Dichapetalum cymosum* was the first recorded plant showing this type of toxicity but it has now been shown that other *Dichapetalum* species (Watt & Breyer-Brandwijk, 1962, p. 383), i.e. *D. macrocarpum* Engl., *D. mossambicense* Engl., *D. stuhlmannii* Engl. and *D. venenatum* Engl. & Gilg contain the same principle. A chemotaxonomic investigation of the distribution of fluoracetic acid in other *Dichapetalum* spp. and in the various genera of the *Dichapetalaceae* might be profitable.

15. *Brachystegia* spp.

Although unfortunately cultivation of members of the genus requires a considerable number of years the genus should nevertheless offer a very fertile field to the experimental taxonomist. Wild (1951) has already shown that there is some correlation between rainfall in Rhodesia and the distribution of ecotypes of *Brachystegia spiciformis*. The correlation shows some weaknesses, however, and probably the picture is somewhat more complicated. Part of this complication is due to the fact that *B. spiciformis* hybridises freely with *B. glaucescens* Burt Davy & Hutch. (? = *B. tamarindoides* Welw. ex Benth.) and produces fertile hybrids sometimes difficult to recognize for what they are in the herbarium although they are easily recognized in the field. In turn, there is a "low-altitude ecotype" of *B. glaucescens* occurring in the southeast of Rhodesia and Mozambique (Wild, 1955) which might repay experimental taxonomic examination. Mr. A. C. Hoyle of the Commonwealth Forestry Herbarium, Oxford, who has worked for many years on *Brachystegia*, is still in some doubt (personal communication) as to whether this taxon may not be a new species, but the position is bound to remain somewhat obscure in the light of orthodox taxonomic methods. Finally, *Brachystegia allenii* Hutch. & B. Davy hybridises freely with *B. boehmii* Taub. on the Zambesi escarpment in both Rhodesia and Zambia. Fertile hybrids forming a complete series between the parents are common and in places indeed seem to be more common than the parent forms.

16. *Ampelocissus obtusata* (Welw. ex Bak.) Planch., La Vigne Amér. **9**: 48(1885). —Wild & Drummond, *Kirkia* **3**: 16(1963).

This species, widespread between the Congo and Tanganyika in the north and the Transvaal in the south, includes two subspecies, *obtusata* and *kirkiana* (Planch.) Wild & Drummond, loc. cit. The range of the two subspecies overlaps somewhat and there are a few intermediates. *Ampelocissus pulchra* Gilg represents a form of subsp. *kirkiana* with dense capitate inflorescences. At present the species seems to be best treated as described above but the position is by no means clear and an experimental taxonomic approach seems desirable.

17. *Rhoicissus tridentata* (L. f.) Wild & Drummond, *Kirkia* **3**: 19(1963).

This species occurs in the Cape Province, Natal and the Transvaal, as well as throughout tropical Africa and in the Yemen. The species occurs in innumerable forms that at present defy analysis.

18. *Cyphostemma humile* (N. E. Br.) Descoings subsp. *dolichopus* (C. A. Sm.) Wild & Drummond, *Kirkia* **3**: 70(1963).

This subspecies occurs in Natal, the Transvaal and Rhodesia. In Rhodesia it is restricted to the serpentine soils of the Great Dyke, a remarkable geological phenomenon containing the largest deposit of metallurgical grade chrome ore in the world and forming an elongated mass of ultramafic and mafic rocks some 332 miles long and 3-5 miles wide (Wild, 1965). In addition to this subspecies there are numbers of other taxa, some newly described in the paper mentioned above which are either endemic to or, like *Cyphostemma humile* subsp. *dolichopus*, confined to the Great Dyke in Rhodesia but which occur in regions isolated from the Dyke either in Rhodesia or in other territories on soils other than serpentinised soils. This pattern of distribution agrees with the work of Stebbins (1942) who in dealing with this situation in the United States comments that the adaption to serpentine can be followed by biotype depletion and the development of some isolated populations into "insular" endemics and that this provides a reasonable evolutionary explanation for serpentine endemics. This matter is more fully discussed in the paper already referred to but truly endemic Dyke species in which biotype depletion is presumably complete belong to the genera *Lotononis*, *Pearsonia*, *Sutera*, *Heeria*, *Barleria*, *Vernonia*, etc. There is also the possibility, of course, that some of the Great Dyke endemics may have developed "ab initio" as also suggested by Stebbins and it is probable that the cultivation of these species and breeding experiments could soon reveal whether they did in fact exhibit extreme biotype depletion.

19. *Helichrysum maestum* Wild, *Kirkia* **4**: 152(1964).

This new species described in an article on the endemic species of the Chimanimani Mts. of Rhodesia is one of a series which the author (Wild, 1964) considers to be composed of vicarious pairs in the sense used by Cain (1944), i.e. "Vicarious species are closely related allopatric species which have descended from a common ancestral population and attained at least spatial isolation." In the case of the vicariads dealt with in this article one partner is endemic to the Chimanimani Mts. and the other in each case to some other mountain mass in neighbouring parts of Africa. A list of these suggested vicariads is as follows:

- Aeschynomene aphylla* Wild (Chimanimani)
 - A. inyangensis* Wild (Inyanga and Melsetter)
- Hesperantha ballii* Wild (Chimanimani)
 - H. longicollis* Bak. (S. Africa and Rhodesia)
- Eriospermum phippisii* Wild (Chimanimani)
 - E. ceciliai* (Inyanga)
- Helichrysum rhodellum* Wild (Chimanimani, quartzites)
 - H. acervatum* S. Moore (Inyanga, Melsetter and Chimanimani Umkondo sandstones)
- Plectranthus caudatus* S. Moore (Chimanimani)
 - P. crassus* N. E. Br. (Mt. Mlanje)
- Hemizygia oritrephes* Wild (Chimanimani)
 - H. obermeyerae* Ashby (Soutpansberg)
- Aloe munchii* H. B. Christian (Chimanimani, quartzites)
 - A. arborescens* Mill., from the Cape to Nyasaland
- Vellozia argentea* Wild (Chimanimani, quartzites)
 - V. velutina* (Pax) Bak., Angola and the Zambezi Valley

Thesium chimanimaniense Brenan (Chimanimani, quartzites)

T. subaphyllum Engl., from Somaliland to Nyasaland

Thesium dolichomeres Brenan (Chimanimani, quartzites)

T. leucanthum Gilg, from Angola

Crotalaria phylicoides Wild (Chimanimani, quartzites)

C. caudata Welw. & Bak., from Angola

Rhynchosia stipata Meikle (Chimanimani, quartzites)

R. friesiorum Harms, from Kenya

Centella obtriangularis Cannon (Chimanimani, quartzites)

C. calliodus (Cham. & Schlecht.) Drude, from the Cape

Erica lanceolifera S. Moore (Chimanimani)

E. planifolia L., of the Cape Province

Erica pleiotricha S. Moore (Chimanimani, quartzites)

E. trichoclada Guthrie & Bolus, from Natal

Helichrysum maestum Wild (Chimanimani, quartzites)

H. pachyrhizum Harv., widely distributed through Southern Africa

A cytological study could presumably reveal whether these pairs should be considered as genuine vicariads, each pair derived from a common ancestor.

20. *Aspilia helianthoides* (Schumach. & Thonn.) Oliv. & Hiern in Oliv., Fl. Trop. Afr. **3**: 381 (1877).—Adams, *Webbia* **12**: 244 (1956); in Hepper, Fl. W. Trop. ed. 2, **2**: 239 (1963).

Adams (*Webbia* **12**: 245) has already remarked on the similarity of *Aspilia helianthoides* subsp. *helianthoides* to the type of *Aspilia africana* (Pers.) Adams. Both these taxa are extremely variable and "it is unfortunate that the Thonning type of *A. helianthoides* cannot be squarely placed near the centre of morphological variation of either of these two species but lies near the shadowy line of differentiation between them, albeit we continue to agree with Adams and with him place this specimen on the *A. helianthoides* side of the boundary" (Wild, in press). The position is further complicated by the fact that although in West Africa *A. africana* has yellow florets and *A. helianthoides* white (or cream), violet or purplish florets, in the Congo, East Africa and Zambia it has yellow flowers. *A. africana* is a perennial, although whether it is invariably so is difficult to tell from herbarium material, and *A. helianthoides* is an annual. Both species occur as weeds and Baker very recently (1964) has commented that the evolution of the weedy habit can often be accompanied by great plasticity of form. In these two *Aspilia* species there is certainly great plasticity and a strong suggestion of hybridity in West Africa at least where both occur together. Polyploid forms are also likely and in short a cytological and genetical investigation is necessary to elucidate the situation more adequately.

21. *Gloriosa superba* L., Sp. Pl. **1**: 305 (1753), sens. lat.

This extremely variable species is widespread in Africa and Asia. In practice, as has been mentioned already by Dyer, Verdoorn & Cood (1962, p. 20), it is not possible to separate it satisfactorily from *G. virescens* Lindl. *G. carsonii* Bak. and *G. rothschildiana* O'Brien may be little more than colour variants. On the other hand Mr. S. Percy-Lancaster, formerly of Salisbury, Rhodesia, but now of the Lucknow Botanic Garden, has brought into cultivation a large number of forms collected in the wild in Rhodesia. These were originally cultivated in Salisbury but



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