

Further Notes on the Amaranthaceae in Papuaia

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Abstract

Additions and corrections are given to an earlier paper on the Amaranthaceae known from the Papuan region. Supplementary data are provided for various species in the genera *Aerva*, *Alternanthera*, *Amaranthus*, *Celosia* and *Gomphrena*. The complex *Amaranthus hybridus* L. s.lat. is reassessed and relevant specimens are referred to the segregate species *A. caudatus* L., *A. cruentus* L. and *A. dubius* Thell., the first one being newly recorded for the region.

The notes presented here provide additions and corrections to an earlier paper (Kanis 1972). A number of new data have since come to my attention in the form of further collections as well as additional literature.

Monographic studies were not made for my review as no Amaranthaceae are endemic to Papuaia, most species being widespread ones introduced into the region. The taxonomic concepts adopted were mostly conservative, an approach that proved quite satisfactory in all genera except partly in *Amaranthus* L. In this paper I follow Sauer's (1950, 1967) narrower species concept in the latter genus.

The following notes have been placed under the relevant taxa, which have been alphabetically arranged and numbered in accordance with my earlier review.

2. AERVA Forsk.

1. *Aerva lanata* (L.) Schultes in Roem. & Schultes, Syst. Veg. ed. 16, 5: 564. 1819.

This combination was validly published for the first time by J. A. Schultes (1819) and not by A. L. de Jussieu (1803) as previously accepted. This matter will be more fully discussed in *Taxon*.

3. ALTERNANTHERA Forsk.

1. *Alternanthera bettzickiana* (Regel) Nichols. Ill. Dict. Gard. 1: 59. 1885, "*A. bettzickiana*"; *Telanthera bettzickiana* Regel, Gartenfl. 11: 178. 1862, non vidi.
A. manillensis auct. non (Walp.) Kanis: Kanis in Contrib. Herb. Aust. 1: 6. 1972.

When I proposed the combination *A. manillensis* for this species, I was unaware of the opinion of Veldkamp (1971) and Van Steenis (1972), who came to a different solution regarding its synonymy. They accepted Nicholson's binomial as validly based on Regel's and, although it is based on reasonable assumption rather than fact, I am now prepared to agree with this opinion.

Walpers's epithet used by me previously has priority over Regel's. However, from recent correspondence with Dr J. A. Mears at PH, I understand that the species described by Walpers was misinterpreted by me, as it is apparently not conspecific

with any material from Papuasias or from the Palaeotropics in general. Furthermore, my original entries under *Gomphrena ficoidea* L. and *G. polygonoides* auctt. non L. in its synonymy should also be excluded and referred to distinct taxa not found in Papuasias.

Mr E. E. Henty (LAE) has sent me some interesting comments regarding this species and I quote the following from his letter:

'There is a common weed here (in Papua New Guinea) ... which keys out to *A. bettzickiana* and which regularly produces fruit, though it is often lacking in (herbarium) specimens. Probably it ripens and falls quickly, and there may not be many produced in a given flower cluster, though obviously total seed production is adequate for rapid spread as a weed ... Most of these wild plants have dried pale green, while the ornamental form usually dried dark.'

A re-examination of herbarium specimens showed that it was possible to separate these quite satisfactorily into two groups using the characteristics mentioned. The ornamental form has been collected from the Madang District in 1958 (*Pullen* 1119), the Eastern Highlands District in 1959 (*Womersley*, NGF s.n.) and New Ireland in 1967 (NGF 29823). All other specimens seen may have been fertile, as pointed out by Henty, and have been collected during or after 1962 from the Central, Morobe and Milne Bay Districts.

4. AMARANTHUS L.

When I first consulted the work on *Amaranthus* by Sauer (1950, 1967) some years ago, I felt that it was too unorthodox to be related in a satisfactory way to earlier, more traditional treatments. Because of identification problems in Australian material, I was induced later on to consult his work again. I found it then most useful for the identification of specimens belonging to the complex *A. hybridus* L. s.lat., especially if the key and the earlier schematic drawings were used together. I have since found that, within this group, three taxa can be distinguished in Papuasias.

I accept Sauer's opinion that the various recognizable taxa in this group are best treated as species, although they probably originated by agricultural selection or by hybridization. They show genetic stability throughout their range, hybrid specimens being relatively rare, and are morphologically well recognizable.

REVISED KEY TO THE SPECIES OF THE GENUS *AMARANTHUS* IN PAPUASIA

- 1a. Mature fruits not opening by circumscision, usually falling entirely with the perianth
 - 2a. Tepals 5 in most female flowers; fruits usually with a smooth light-coloured conical beak, distinct from the wrinkled darker main body 2. *A. interruptus*
 - 2b. Tepals 3 in most female flowers; fruits without a distinct top part, entirely wrinkled or smooth
 - 3a. Ripe fruits rather smooth; leaf blades ovate to obovate, 1–3 cm long 4. *A. lividus*
 - 3b. Ripe fruits distinctly wrinkled; leaf blades ± trullate, 3–7(–10) cm long 7. *A. viridis*
- 1b. Mature fruits opening by circumscision, the upper part falling with the seed, the lower part persisting with the perianth
 - 4a. Tepals 3 per flower, distinctly awned and strongly recurved like the bracts, 3–5 mm long in female flowers 6. *A. tricolor*
 - 4b. Tepals 5 per flower (occasionally 3 or 4 in some male flowers), ± mucronate, 1.5–2.5 mm long in female flowers

- 5a. Tepals about equal in length, the perianth $\pm$ recurved against the ripe fruit
 - 6a. All flower clusters unarmed, awns of all bracts less than 2 mm long; flowers mostly female, only the initial one of each cluster male 1c. *A. dubius*
 - 6b. Flower clusters in leaf axils with 1 or 2 spines (metamorphosed bracts) 5–20 mm long; flowers all female in lower clusters, all male in upper clusters 5. *A. spinosus*
- 5b. Tepals distinctly unequal in length, the perianth $\pm$ spreading away from the ripe fruit
 - 7a. Bracts mucronate, shorter than the perianth, about as long as the wrinkled dark fruit 3. *A. leptostachyus*
 - 7b. Bracts long-awned, overall about equal to or slightly longer than the perianth, shorter than the smooth pale fruit
 - 8a. Tepals $\pm$ recurved in fruit, with distinctly overlapping margins, the inner ones obtusely spatulate; stigmas divergent, $\pm$ recurved, widened at the base and together forming a 3-sided saddle 1a. *A. caudatus*
 - 8b. Tepals straight in fruit, the margins not or hardly overlapping, the inner ones acutely oblanceate, stigmas erect, straight, slender at the base and attached to a short cylindrical beak 1b. *A. cruentus*

1a. *Amaranthus caudatus* L. Sp. Pl. 990. 1753. *Type*: From 'Peru, Persia, Zeylona'.

The species originated in South America, probably by selection from material belonging to *A. quitensis* Kunth, during a long period of domestication. It is primarily grown as a grain crop in parts of tropical America, Africa and continental Asia, whereas strongly coloured forms are cultivated as ornamentals in various parts of the world.

So far I have seen only one collection of this species from Papuaia: *Bowers* 312, Western Highlands District, Upper Kaugl Valley, 2200 m, Nov. 1968 (LAE). It was reportedly collected from cultivation as a green vegetable, but it is remarkable for its ivory white seeds, a characteristic favoured in grain crops elsewhere. Its introduction into the region, possibly by missionaries, must be very recent, its immediate origin being unknown.

1b. *Amaranthus cruentus* L. Syst. Nat. 2: 1279. 1759; *A. hybridus* var. *cruentus* (L.) Mansf. in Kulturpfl. Beih. 2: 54. 1959, sub ssp. *cruentus* (L.) Thell.; Brenan in Watsonia 4: 269. 1961, sub ssp. *incurvatus* (Timeroy ex Gren. & Godr.) Brenan.

A. paniculatus L. Sp. Pl. ed. 2, 1406. 1763; Ridl. in Trans. Linn. Soc., Bot. 9: 139. 1916; *A. hybridus* var. *paniculatus* (L.) Uline & Bray in Mem. Torrey Bot. Club 5: 145. 1894; Thell. Fl. Adv. Montpell. 205. 1912, sub ssp. *cruentus* (L.) Thell. *Type*: Herb. Linn. 1117.20 from 'America' (cf. Sauer 1967).

A. hybridus auct. non L.: Kanis in Contrib. Herb. Aust. 1: 8. 1972, p.p.

In my earlier review this taxon was treated as a cultivated variety of *A. hybridus* L. in accordance with Backer (1949) and others. I have since accepted Sauer's (1950, 1967) opinion that it is best treated as a species in its own right. It originated in Central America, presumably by selection from material belonging to *A. hybridus* L. s.str., during many centuries of cultivation.

A number of Papuan collections of the related species *A. dubius* Thell. were previously referred by me to *A. hybridus* L. and consequently the distribution of the

latter taxon in Papuasias was misinterpreted. Furthermore, I have since learned that the West New Guinean collections referred by Ridley (1916) to *A. paniculatus* L. also belong here, and not to *A. viridis* as suggested by me in 1972. The following Papuasian specimens are now placed in *A. cruentus*:

WEST NEW GUINEA: Snow Mountains, Wissell Lakes region, *Eyma* 4934, 4935, 4936, 5096, 5350 (all 1939); Upper Utakwa River, *Kloss* s.n. (1912, 1913) (BM, K, not seen); Baliem Valley, BW 10458 (1961).

EAST NEW GUINEA: West Sepik District, Telefomin Subdistrict, *Steinkraus* 19 (1965); Western Highlands District, Kapiago Subdistrict, ANU 9556 (1970); Hagen Subdistrict, *Bowers* 108 (1962), 313 (1968); Southern Highlands District, Tari Subdistrict, UPNG 1736 (1972); Chimbu District, Upper Chimbu Subdistrict, *Borgmann* 422 (1960); Kundiawa Subdistrict, *Hide* 122, 126 (1972), *Reeve* 4 (1972); Eastern Highlands District, Kainantu Subdistrict, ANU 5857 (1966); Morobe District, Mumeng Subdistrict, *McKee* 1545 (1954).

The species is probably associated exclusively with areas under cultivation at 1200–2200 m altitude. Its oldest records in West New Guinea (Utakwa River, 1912) and East New Guinea (Mumeng Subdistrict, 1954) do not provide us with a reliable key to the history of its introduction into the region. It could well have been established throughout the central cordilleras before the arrival of European man, its source area being unknown.

According to Backer (1949) the species was introduced very long ago into Malesia (Sumatra, Java, Lesser Sunda Islands). It is said to be cultivated as an ornamental in Java from the lowlands up to c. 1300 m altitude, where it also occurs as a garden escapee but not as a naturalized species. In New Guinea it is grown as a green vegetable, the inflorescences usually not strongly coloured with purple as in ornamental specimens. It was once reported as 'planted as a fetish among crops' near Lae (Sauer 1967). Individual plants (escapees?) may develop into dwarfed specimens, with strongly reduced leaves and inflorescences that are nevertheless fertile.

In my earlier review I included *A. hybridus* subsp. *cruentus* var. *paniculatus* (L.) Thell. in the synonymy of *A. hybridus* L. However, the combination *A. hybridus* var. *paniculatus* was first made by Uline and Bray (1894) as recognized by Thellung and is not illegitimate as stated by me then. On the other hand, its subsequent use by Thellung (1912) and Backer (1949) under *A. hybridus* subsp. *cruentus* (L.) Thell. was illegitimate, as in Thellung's concept this variety includes the type of *A. cruentus* L. I still accept that the correct name at varietal level is *A. hybridus* subsp. *incurvatus* var. *cruentus* (L.) Mansf.

1c. *Amaranthus dubius* Mart. ex Thell. Fl. Adv. Montpellier. 203. 1912. Type: from tropical America.

A. hybridus auct. non L.: Kanis in Contrib. Herb. Aust. 1: 8. 1972, p.p.

In my earlier review I did not recognize this species among Papuasian collections, referring the relevant ones to *A. hybridus* L. s.lat. instead. It was not recorded from the region in the literature until some collections named by Sauer were quoted by van Steenis (1972). It has presumably arisen in Central America as an allopolyploid hybrid of *A. spinosus* L. and either *A. hybridus* L. or the related *A. quitensis* Kunth.

With the aid of Sauer's (1950, 1967) work I was able to determine as *A. dubius* a number of collections seen by me earlier, as well as some additional ones. Presently the following are known from Papuaia:

WEST NEW GUINEA: Star Mountains, *Kalkman* 4556 (1959).

EAST NEW GUINEA: East Sepik District, Ambunti Subdistrict, *Townsend* 12 (1960); Madang District, Bogia Subdistrict, *Pullen* 1113 (1958); Usino Subdistrict, *Hoogland* 5104 (1955); Morobe District, Lae Subdistrict, NGF 12087 (1968); Wau Subdistrict, NGF 7384 (1957), 27978 (1966), BMF 7 (1967); Gulf District, Malalaua Subdistrict, *Craven and Schodde* 892 (1966); Central District, Port Moresby Subdistrict, *Carr* 13049 (1935).

BISMARCK ARCHIPELAGO: West New Britain District, NGF 30415 (1966); East New Britain District, *Carman* 1 (1968).

SOLOMON ISLANDS: Bougainville, NGF 30604 (1967).

The oldest collection from the region was made in the Central District in 1935 and the species was therefore definitely introduced into Papuasias before World War II. However, as all other collections were made from 1945 onwards, it is assumed that it was a relatively recent introduction. Besides, it was noted at the time that the first collection from West New Guinea (Star Mountains, 1959) was of a recent introduction in that district. A westward migration route through New Guinea, as suggested for *A. hybridus* L. s.lat. in my earlier paper, could therefore well be a correct assumption for *A. dubius*.

The species is cultivated as a green vegetable, but it also occurs as a weed in plantations, garden areas, and secondary vegetation, from sea level up to c. 1300 m altitude. It should be noted that in Papuasias it is essentially a lowland species in contrast to *A. cruentus*, which is usually found well above 1200 m.

2. *Amaranthus interruptus* R.Br.

In my earlier review the collection BSIP 129 was doubtfully referred to *A. hybridus* L. s.lat., judging from its inadequate description by Walker (1948). A specimen of this collection was recently received from BRI and proved to belong to *A. interruptus* R.Br., being an unusually tall representative of that species. It constitutes the first record from the Solomon Islands (Guadalcanal Island, Point Cruz) and the only record from Papuasias in this century. It was probably introduced from Australia during World War II.

4. *Amaranthus lividus* L.

The earliest Papuasian collection of this species presently known was made in 1954 near Aiyura, Eastern Highlands District (*McKee* 1285). It was then reported as a frequent garden weed on a ridge at the edge of the rain forest. A collection made from the Western Highlands District in 1970 (NGF 42960) represents an extension of the very limited area of distribution previously known. The highest occurrence recorded is at c. 1850 m altitude (*Borgmann* 423).

Papuasian specimens of this rather polymorphic species all appear to match the description of subsp. *polygonoides* (Moq.) Thell. (1914).

6. *Amaranthus tricolor* L.

Cultivation of this species as a green vegetable has also been reported from West New Guinea (*Brass* 11219, 18 km NE. of Lake Habbema, 2200 m alt., 1938).

7. *Amaranthus viridis* L.

'*A. paniculatus* auct. non L.: Ridley (1916)' was incorrectly listed by me in the synonymy of *A. viridis* L. (see under *A. cruentus* L.).

5. CELOSIA L.

1. *Celosia argentea* L.

A recent study of this species by Khoshoo and Pal (1973) points at the Indian subcontinent as its most likely area of origin. It also shows that the cultivated form, originally described as *C. cristata* L., is worthy of taxonomic rank, being genetically stable. I differ from these authors in that I prefer to treat it as a variety under the name *C. argentea* var. *cristata* (L.) Kuntze. Acceptance at specific level is less appropriate as its morphologically distinguishing characters are more-or-less of a monstrous nature, whereas it has not shown to be really viable outside cultivation.

8. GOMPHRENA L.

1. *Gomphrena celosioides* Mart.

The earliest collection of this species presently known from Papuaia (Sawyer 269) was made in September 1945 in the vicinity of Finschhafen, Morobe District. This additional record supports the assumption that its introduction into the region was caused by aircraft movements from Australia or the Pacific during World War II, and that it is quite independent of pre-war introductions into Western Malesia.

2. *Gomphrena globosa* L.

This species was re-collected (LAE 50153) in 1970 on Long Island, Madang District. It was reported to be growing as a weed in plantations at sea level. It is not impossible therefore that it became locally established in other parts of Papuaia.

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I am indebted to the Director of the Rijksherbarium, Leyden, who sent a generous loan of Papuanian *Amaranthaceae* not previously seen, and to the Chief, Division of Botany, Lae, who sent some additional collections of *Amaranthus* spp. for identification as well as earlier ones for re-examination.

I also thank Dr J. A. Mears of the Academy of Natural Sciences (PH) and Mr E. E. Henty (LAE) for information about *Alternanthera bettzickiana* (Regel) Nichols., and Mr G. M. Chippendale, at the time Australian Liaison Officer at the Royal Botanic Gardens, Kew, U.K., for information about some collections at Kew and the British Museum here listed under *Amaranthus cruentus* L.

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