

# A new, endangered species of canopy tree from the evergreen forests of Ghana and Liberia, *Synsepalum ntimii* (Sapotaceae)

William D. Hawthorne

Dept. of Plant Sciences, University of Oxford, South Parks rd., Oxford, GB-OX13RB, United Kingdom  
E-mail: Will.hawthorne@btopenworld.com

**Background and aims** – Botanical surveys in Ghana yielded numerous new species, including saplings of what proved to be a tall, canopy tree. After several years, adults with flowers and fruits were found.

**Key results** – *Synsepalum ntimii*, a new species similar to *S. afzelii*, is described and its affinities are discussed.

**Conservation status** – Upper Guinea is fairly well surveyed compared to many other tropical regions, and the species has a limited range, so it is classified as Endangered in the IUCN system, even though recent surveys have extended the known range of *S. ntimii* to SE Liberia. It is locally rare, and much of the known Liberian range will be subject to mining operations.

**Key words** – Sapotaceae, *Synsepalum*, *Afrosersalisia*, Ghana, Liberia, endangered, canopy tree, evergreen forest.

## INTRODUCTION

During forest inventories and conservation-orientated botanic surveys in the 1990s, sterile specimens of an unidentifiable woody plant species turned up from several plots in the Wet Evergreen forests (Hall & Swaine 1981) of SW Ghana. The specimens were from ‘hotspot’ forest rich in known, globally rare species (Hawthorne & Abu Juam 1995) and after extensive searches in herbaria in Europe and Ghana, it seems no specimens of the species had been collected before, at least from Africa, showing that even in a relatively well known tropical forest flora like that of Ghana there is much basic inventory and exploration to be done. Eventually, adults were located by Mr. Ntim Gyakari of Ghana Forestry Department, in Ankasa forest (protected as a National Park) and nearby in Cape Three Points Forest Reserve (F.R.). The earlier sterile specimens did prove to be juveniles of a large canopy tree. In 2002 and 2003 fruiting and flowering material was collected from Cape Three Points F.R. One of the areas in Cape Three Points F.R. that includes the new species and many other rarities has become specially protected by the government of Ghana, as a Globally Significant Biodiversity area (GSBA) where no logging or similar disturbance is allowed (Hawthorne & Abu Juam 1995).

The discovery is remarkable because Ghana is relatively well sampled compared to many other tropical countries, and new species of large forest tree are discovered infrequently anywhere in Africa. The new species had been overlooked because: it is clearly rare, even locally; deeply fluted, thus of

no commercial interest to loggers; it is easily confused with various other Sapotaceae; its flowers are very inconspicuous; and the ripe fruits seem to be soon eaten by animals.

Later, in 2012, the species was found in botanic surveys in Liberia: in Sapu National Park (N.P.) by Jongkind et al.; and independently by the author and colleagues in the same year, nearby in the Putu Hills, where seven individuals were recorded, on the slopes and hilltops of Mt Jideh and Mt Montroh, in an area destined to be mined for Iron Ore.

The species was included informally in Hawthorne & Jongkind (2006: 108, 109), but is finally described formally here. The new species is typical of tribe Chrysophylleae with five imbricate sepals, five undivided petals, five stamens and an adaxial seed scar; conforming to parts of *Synsepalum* (DC) Danniell (both taxa here sensu Pennington 1991), with: rotate corolla (*Pradosia* type flowers, sensu Pennington *loc. cit.*: 82); spreading corolla lobes far exceeding the tube; exerted stamens fixed at the top of the corolla tube; minute staminodes; no stipules. It differs from species in the closely related genus *Englerophytum* A.Chev. by: lacking the distinctive closely striate secondary venation of *Englerophytum* (although the venation is closer to that pattern than all other known *Synsepalum* species); lack of stipules; and free filaments. As the seed scar covers less than half the surface of the single seed examined, the new species does not key clearly to *Synsepalum* nor indeed to any genus in Pennington’s key (1991: 182–184), though the presence or absence of endosperm in the seed and the nature of the cotyledons and radicle is not known, the single mature seed having been

left intact. It is, however, most similar to species previously placed in *Afrosersalisia* (now *Synsepalum*) and I am grateful to Dr. T. Pennington (Royal Botanic Gardens Kew, pers. comm.) for confirming its placement in *Synsepalum*.

#### MATERIALS AND METHODS

Specimens (normally sterile) associated with Rapid Botanic Survey (RBS) originally alerted the author to the new species. Orthodox herbarium collections were made when fertile individuals were found. Older specimens, either unidentified or previously named, were sought across potential genera in herbaria (GC, FHO, K, WAG) and online via JSTOR Global Plants (<http://plants.jstor.org>); however no existing unidentified or misidentified specimens amongst other species were found in the herbaria. The fertile types have been distributed to several herbaria. Photographs taken during the collection of the type specimen have proved useful for adding to the description, and for publicising the new species for conservation purposes. In 2013, known localities in Ghana were revisited and leaf specimens collected both as orthodox herbarium collections and fragments were placed directly in silica gel for DNA analysis (marked as '(DNA sample)' with the cited specimens below).



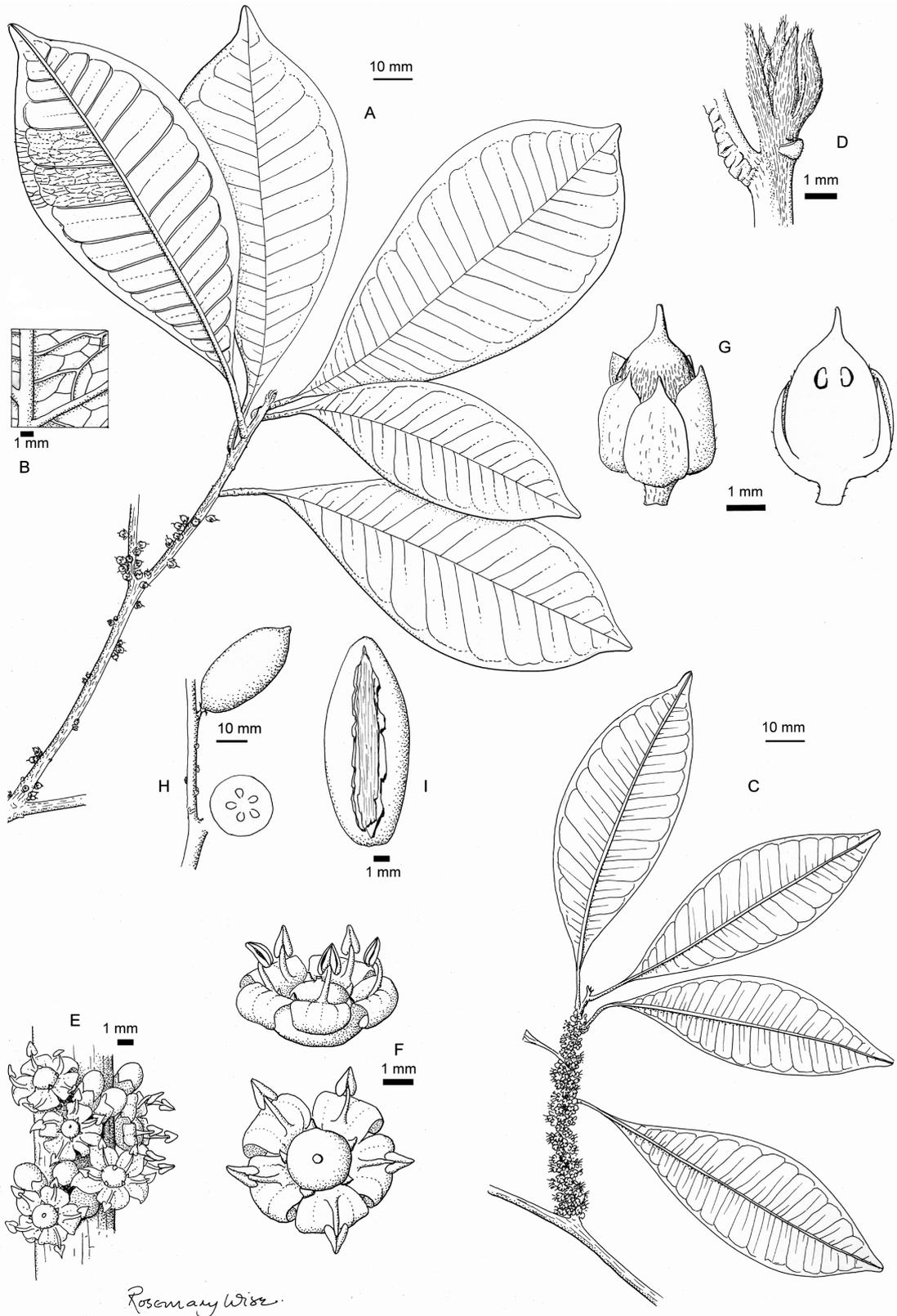
**Figure 1** – *Synsepalum ntimii*: fluted bole and crown, in Cape Three Points F.R., Ghana. Photograph by W.D. Hawthorne.

#### TREATMENT OF THE NEW TAXON

##### *Synsepalum ntimii* W.D.Hawthorne, sp. nov.

A large tree most similar to *Synsepalum afzelii* (Engler) Pennington and *S. cerasiferum* (Welw.) Pennington (both previously in *Afrosersalisia* A.Chev.). Differing from both in the glabrous ovary (vs. covered in dense, c. 1 mm long, appressed orange-brown hairs in *S. afzelii* and *S. cerasiferum*); shorter pedicels (0–1 mm long in *S. ntimii*; 1–8 mm in *S. afzelii* and *S. cerasiferum*). *S. ntimii* also differs in leaf venation: the 11–19 pairs prominent lateral nerves are interspersed with equally prominent reticulate venation prominent below, with many of these second and third order veins tending to run parallel to the main laterals; whereas both *S. afzelii* and *S. cerasiferum* lack prominent finer reticulations below, and there is a clear distinction between the 9–16 prominent lateral nerves and obscure, scalariform or impressed finer venation below. – Type: Ghana, Western Region, Cape Three Points Forest Reserve, hills in NE, alt. 50 m, 23 Feb. 2003, Hawthorne & Gyakari 203a024 (holo-: FHO; iso-: BR, GC, K, MO, P, WAG).

**Tree** to 35m tall. Bole to c. 50 cm diameter above buttresses, deeply fluted up to main branches (fig. 1), flutes merging with edges of the tall, straight or concave-edged buttresses, with basal diameter across the widest buttresses 3–5 times the diameter above buttresses, and up to c. 2 m DBH (including flutes and buttresses) (fig. 3A). **Bark** grey to reddish or orange-brown, rough and flaky in parts or rather smooth, with raised, horizontal fine (c. 2 mm) ridges or hoops on smoother parts; with occasional horizontal ridges or 10–20 cm knee-like bosses; bark slash reddish-orange, fibrous, thin, with abundant white latex. **Branchlets** with leaves clustered towards tips (fig. 3C–D); Aubréville's architectural model (Hallé et al. 1978); apical bud and youngest internode appressed pubescent, soon glabrous; without obvious stipules, even in the apical bud. Older branchlets, slightly rugose, with numerous elliptic lenticels; old fertile branches covered with many small 1 mm knobs at old nodes where flowers are clustered or have fallen. **Leaves** alternate, spirally arranged, oblanceolate to obovate, occasionally elliptic, apex acuminate with rounded acumen tip, or (especially on flowering shoots) apex fully rounded, without acumen, and/or emarginate; leaf base decurrent with c. 1 cm of basal section of lamina < 3 mm wide on larger leaves. **Petiole** (below decurrent section of lamina) 0–9 mm long, appressed puberulous at first, soon glabrous. **Lamina** (including narrow, decurrent section above petiole) 6.5–13 × 2.0–5.0 cm on fertile specimens, up to 22 × 9 cm in shade leaves and saplings; length/width ratio 2.2–3.2; coriaceous, glabrous or with few minute appressed hairs when developing; margin thickened, slightly recurved near base on dried leaves. Midrib prominent on both surfaces, but the prominent midrib sometimes impressed within a channel above. Lateral nerves: 11–19 pairs main secondary nerves directly joining a loopy sub-marginal nerve 1–3 mm from margin, but with intermediate densely reticulate secondary and tertiary nerves similarly thick and prominent below, leaving little space for fourth order or finer venation, and often aligned and suggesting > 19 parallel lateral nerves at arm's length. Secondary and finer venation above sometimes finely channelled. **Flow-**



**Figure 2** – *Synsepalum ntimii*: A, flowering branch with obovate leaves and few flowers; B, venation l.s.; C, flowering branch with elliptic – oblong leaves and denser flowers; D, apical bud; E, part of flowering branch; F, details of flower; G, gynoecium after corolla fall, with vertical section; H, mature fruit on branchlet, with transverse section of 5-locular ovary; I, seed showing ventral scar. A–F from Hawthorne & Gyakari 203A024 (FHO); G–I from Hawthorne & Dabo 203b301 (FHO). Drawn by R. Wise.

ers in fascicles, forming a dense brush along branchlets on old nodes immediately below current leaves, with occasional flowers in axils of current leaves (fig. 3C–F); sessile to sub-sessile, pedicels 0–1 mm long; smelling of rancid hay or fermented cocoa-waste. Calyx with 5 sepals imbricate (quincuncial) even in fruit, c. 1.5 mm long; very short tube or connate section c. 0.5 mm long at base, lobes broadly ovate to orbicular, c. 1–1.5 mm long × 1–1.5 mm wide, appressed puberulous on outer surface. Corolla rotate, with 5 petals imbricate in bud, 4–5 mm diameter when open; connate basal section (short tube) 0.2 mm; lobes rounded or abruptly acute at apex, 2.5 long × 1.2–2 mm wide, becoming recurved, yellow, soon falling and abundant on ground below flowering trees (fig. 4A–D). Stamens five, 2.25–2.5 mm long; filaments joined to base of corolla lobes at mouth of tube, c. 1.5 mm long; anthers broadly ovate and deeply cordate, extrorse, c. 1 mm long × 1 mm wide at base. Staminodes rudimentary, between corolla lobes, variable in form, acute, ligulate or three-lobed, c. 0.2 mm long × 1 mm wide; corolla soon falling to leave ovary tightly wrapped in imbricate calyx with apical portion and style emerging. Style 0.5–1 mm long, unlobed; ovary hemispherical, c. 1 mm radius, five-locular, glabrous, but with membranaceous, darker coloured nectary disc surrounding the lower half, the disc obscurely divided into c. sixteen ligulate lobes, bathed in copious nectar. Fruit an ellipsoid berry with a fleshy to soft-leathery pericarp, 3.5 × 1.5 cm, one-seeded, dark reddish, drying black. Seed (single undissected specimen possibly immature) ellipsoid 15 mm long × 7 mm wide, flattened on adaxial face, yellow to orange-red, slightly shiny with rough 10 × 1.5 mm scar along adaxial edge. Figs 2, 3 & 4A–D.

**Other collections examined – Ghana:** Western Region, Ankasa forest, 13 Jan. 1998, sterile, Hawthorne, Abu Juam, Ekpe & Gyakari ANKA372 (FHO); *ibid.*, 15 Jan. 1998, sterile, Hawthorne, Abu Juam, Ekpe & Gyakari ANKA536 (FHO); *ibid.*, sterile (DNA sample), Hawthorne, Marshall & Dabo 213a407 (FHO); Neung North F.R., GSBA plot NEUNR2, 19 Apr. 2002, sterile, Hawthorne, Ekpe & GSBA team NEUNG0311 (FHO); Cape Three Points F.R. in GSBA, 21 April 2001, sterile (DNA sample), Hawthorne, Gyakari & Dabo 201a135 (FHO); *ibid.*, alt. 150 m, 20 Feb. 2013, sterile (DNA sample), Hawthorne, Marshall & Dabo 213a260 (FHO); *ibid.*, Hawthorne, Marshall & Dabo 213a280 (FHO); Cape Three Points F.R. NE section (type locality), 10 May 2003, Hawthorne & Gyakari 202a206; *ibid.*, 22 Jun. 2002, fr., Hawthorne, Gyakari & Dabo 203b301 (FHO, GC).

**Liberia** (all are sterile specimens): Sapo National Park, nr. Camp 6, 22 Nov. 2010, Jongkind *et al.* 9831 (FHO, WAG); Putu Hills east ridge (Mt. Jideh), 18 Jan. 2010, Jongkind *et al.* 9107 (FHO, WAG); *ibid.*, 1 Dec. 2010, Hawthorne, Ekpe & Marshall PTEP1201 (FHO); *ibid.*, 11 Dec. 2010, Hawthorne, Ekpe & Marshall CM524 (FHO); Putu Hills Tiameh Town to Mt. Montroh, 16 Dec. 2010, Hawthorne, Ekpe & Marshall PTEP2758 (FHO); *ibid.*, 16 Dec. 2010, Hawthorne, Ekpe & Marshall PTEP2690; Putu hills, Daniel’s camp, 11 Dec. 2010, Hawthorne, Ekpe & Marshall PTEP2280 (FHO); Putu Hills Mt. Ghi, 4 Dec. 2010, Hawthorne, Ekpe & Marshall PTEP11471 (FHO).

**Habitat and distribution** – A canopy tree on well-drained ridges and slopes (alt. 50 m) in Wet Evergreen Forest (*sensu* Hall & Swaine 1981) of SW Ghana; and in similar evergreen forest (200–600 m) in the Putu Hills and Sapo NP, SE Liberia (fig. 4E). The saplings, to 2 m at least, are shade-tolerant, occurring in the deepest understorey shade. The species is to

be expected in the same Wet Evergreen forest type, nearby in SW and SE Ivory Coast.

**Phenology** – Flowers in February (near end of dry season); ripe fruits in June (rainy season).

**Field Notes** – Saplings and young, sterile trees of *S. ntimii* can be confused with various other Sapotaceae which grow in the same forest and have similar bark and clustered leaves, *Terminalia*-style branching and latex (Hawthorne & Gyakari 2006: 64–79), including: *Neolemoniera clitanrifolia* (A.Chev.) Heine, which however has distinctive venation (see Hawthorne & Jongkind 2006); and especially *Synsepalum afzelii* (Engl.) T.D.Penn. The latter has subtly different, generally smaller, less acuminate leaves, a more brittle, plastic-like texture and less apparent venation; and usually has a bright red flush of new leaves (fig. 5D–E) not seen in *S. ntimii* (fig. 5F). Mature trees of *S. ntimii* are strikingly fluted (fig. 1), more so than these other species (fig. 5B–C), though the buttresses are similar (figs 3A–B, 5A).

**Conservation Status** – The species is legally protected in Ghana, both by virtue of it being classified as a Black Star Species and by occurring in protected areas (‘GSBAs’), set up with selected Forest Reserves on the basis of high concentrations of such species (Hawthorne & Abu Juam 1995). In spite of having a high Extent of Occurrence (33,166 km<sup>2</sup>), from Ghana to Liberia, It qualifies as Endangered in the IUCN system (IUCN, 2001) by virtue of having a low Area of occupancy (AOO = 28 km<sup>2</sup>, measured at 2 km resolution); and by having a rather low population density in localities where it is known. The Putu Hills population in Liberia, where it is more common than in its other known localities, is liable to be seriously diminished by mining in the coming decade. The survey there was an Environmental Impact assessment prior to mining, though a third of the Putu Hills records were from sample areas outside of any proposed mine footprint.

**Etymology** – Named after former curator of the Forestry Herbarium, Kumasi, Ghana, fellow dendrophile, and herbalist and field botanist extraordinaire, Mr. Ntim Gyakari (fig. 3B).

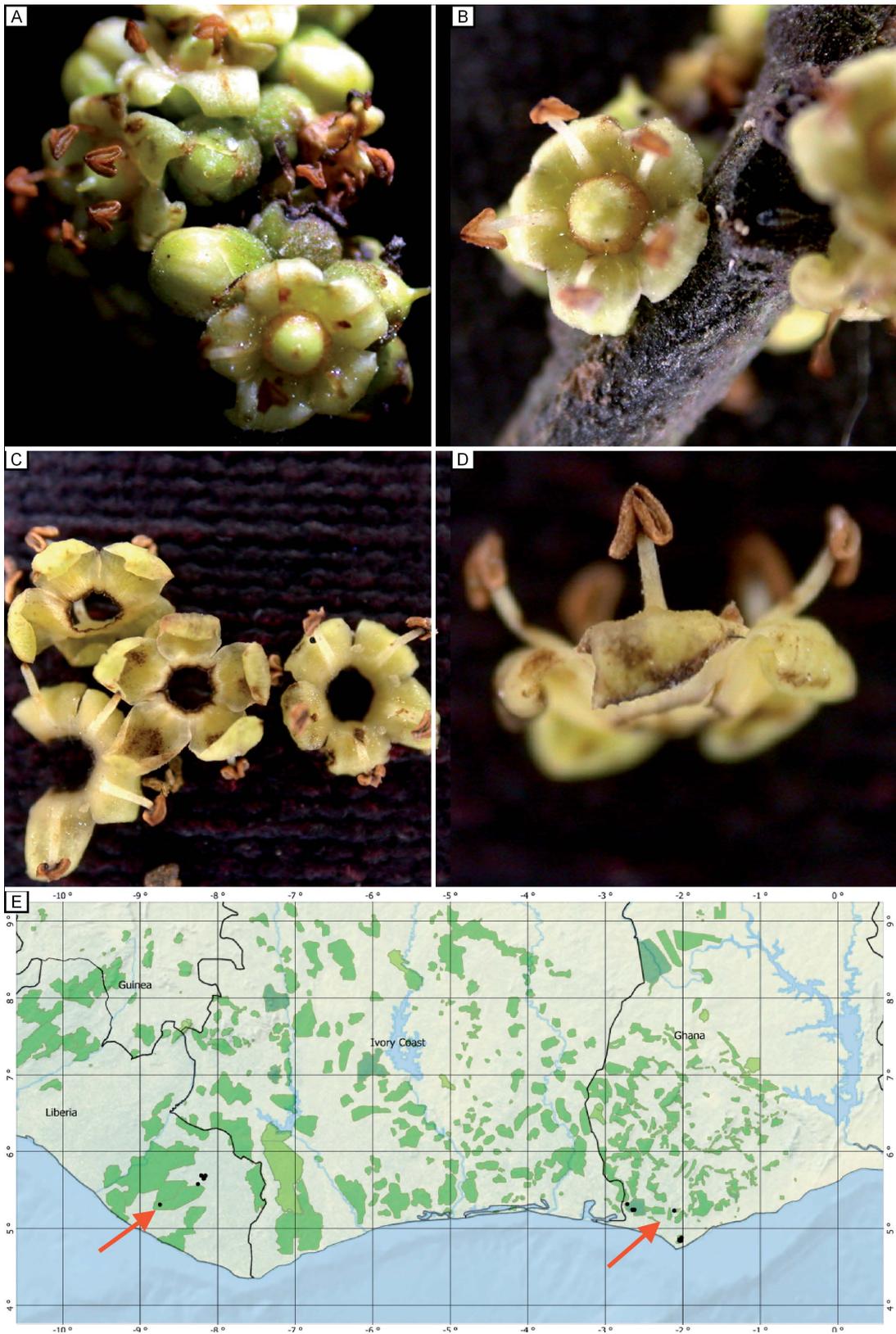
## CONCLUSION

The recognition of this species as new, and within the current circumscription of *Synsepalum*, is confirmed at the time of submission of this paper by a phylogenetic study of *Synsepalum* and *Englerophytum* (Borg 2013, B. Mackinder, Royal Botanic Gardens Edinburgh, pers. comm.). The new species extends slightly the limits of *Synsepalum*, already a heterogeneous genus after the sinking of genera such as *Afroseralisia* by Pennington, and the new species is perhaps closer to *Englerophytum* than other species in the genus.

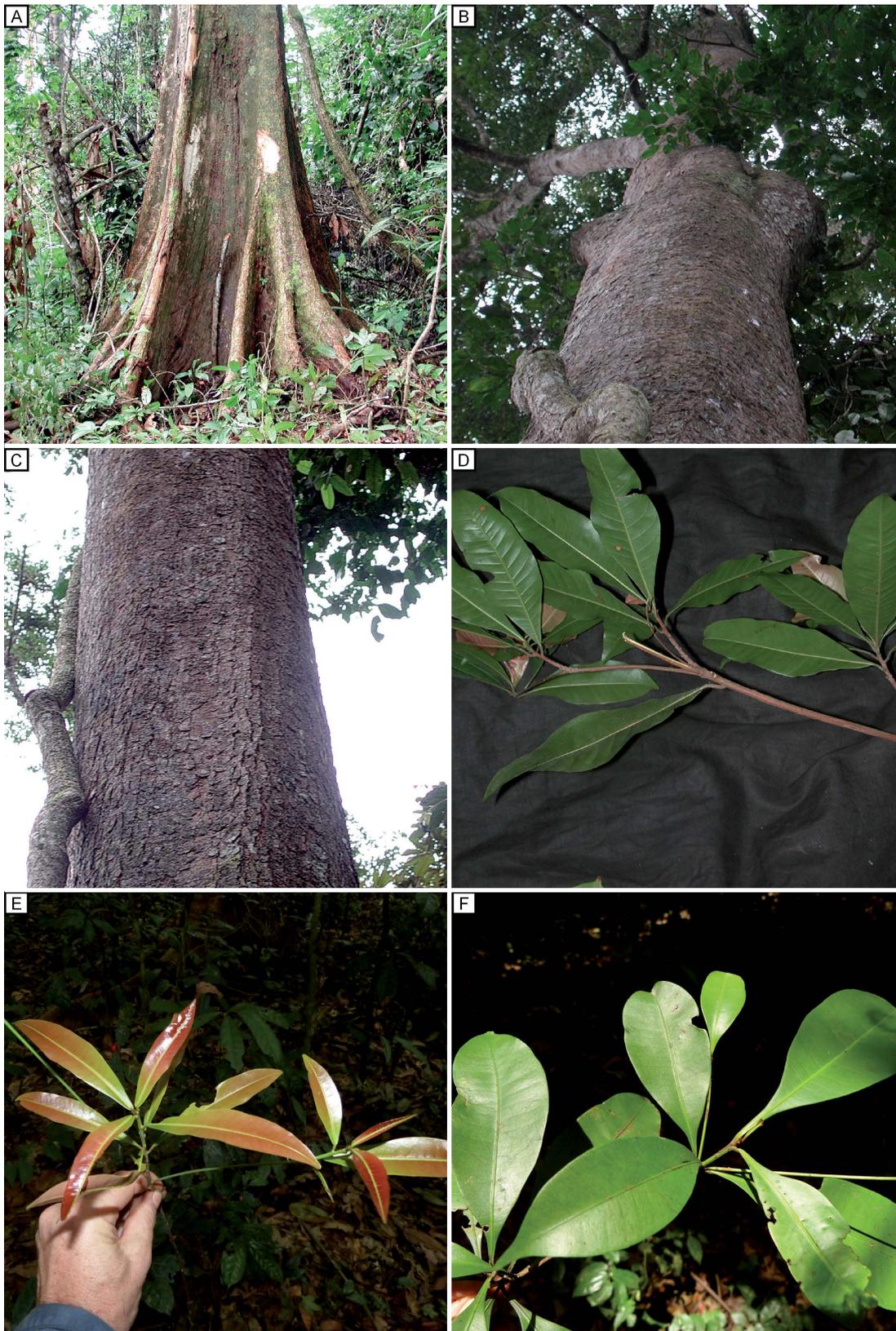
The Ghanaian government has done much to conserve the local hotspots in which this and other rarities survive, and at the other end of its range, Sapo N.P. in Liberia should provide another refuge, though only one tree has been reported from Sapo and the generally low population densities of *S. ntimii* and increasing pressure from mines, logging and farms in the surrounding landscape are a serious concern.



**Figure 3** – *Synsepalum ntimii*: A, buttresses; B, eponymous Ntim Gyakari (left), with J. Dabo, co-collectors, as scale for buttresses; C, flowering branches; D leaf surface and flowering branchlet; E, detail of fascicles showing open flower (centre), flower with falling corolla (arrowed) and older flowers (top left); F, single flower in leaf axil. C–F from Hawthorne & Gyakari 203A024 (FHO). Photographs by W.D. Hawthorne.



**Figure 4** – *Synsepalum ntimii*: A, detail of flower with nectar (bottom right); B, detail of ovary, girdled by brown membranaceous disc; C, fallen corolla from forest floor; D, fallen corolla, lateral view showing extrorse stamen; E distribution map, with arrows indicating the two regions in which the species is known, black circles showing specimen localities. Fully protected areas and forest reserves are shown in green (source UNEP/WCMC <http://www.protectedplanet.net>), accounting for most of the remaining forest. A–D from Hawthorne & Gyakari 203A024 (FHO). Photographs by W.D. Hawthorne.



**Figure 5** – *Synsepalum afzelii*: A, buttresses, similar to those of *S. ntimii*; B, upper part of bole; C, middle part of (subcylindrical) bole – compare high fluting in *S. ntimii* (fig. 1); D, branchlet showing reddish new leaves; E, sapling shoot with reddish new leaves. *Synsepalum ntimii*: F, sapling shoot with green new leaves. A from Hawthorne & Gyakari 201B125 (FHO), B–D from Hawthorne & Gyakari 201A121 (FHO), E from Hawthorne et al. 213A169 (FHO), F from Hawthorne et al. 213A260 (FHO). Photographs by W.D. Hawthorne.

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