

# Eight new species of *Ixora* (Ixoreae - Rubiaceae) from Madagascar

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**Background and aims** – *Ixora* L. is one of the largest genera of the Rubiaceae, and badly known taxonomically. New species are described as a precursor to the author's revision of *Ixora* in Madagascar.

**Methods** – Methods follow normal practice of herbarium taxonomy.

**Key results** – Eight new *Ixora* species from Madagascar are recognized. Detailed descriptions, illustrations and distribution maps are provided for each species.

**Key words** – *Ixora decaryi*, *Ixora fuscovenosa*, *Ixora gautieri*, *Ixora longipedicellata*, *Ixora masoalensis*, *Ixora pallens*, *Ixora pedalis*, *Ixora ripicola*, Madagascar, Rubiaceae.

## INTRODUCTION

With an estimated 530 species (Davis et al. 2009), *Ixora* L. is one of the largest genera of the Rubiaceae. The genus is badly known taxonomically. No worldwide monograph exists, but some recent flora treatments or regional revisions (e.g., Bridson 1988, 2003, De Block 1998) were published. *Ixora* has a pantropical distribution with c. eighty species in Africa (continental Africa and Madagascar) and c. fifty species in the Neotropics (Govaerts et al. 2011), but the centre of diversity is Asia and the Pacific.

Recently, *Ixora* was the focus of detailed molecular studies. Mouly et al. (2009) placed *Captaincookia* N.Hallé, *Doricera* Verdc., *Myonima* Comm. ex A.Juss. and *Versteegia* Valetton into synonymy with *Ixora* and continued the broadening of the genus concept already started by Guédès (1986) so that *Ixora* now also includes species with multilocular ovaries. A detailed study of the phylogeny and biogeography of the Madagascar *Ixora* species was also recently published (Tosh et al. 2013).

*Ixora* is a genus of shrubs and trees widely distributed in Madagascar, growing in humid or, more rarely, in (semi-) deciduous dry forest. The genus is easily recognized by the following characters: petioles articulate; inflorescences terminal; inflorescence branching trichotomous, articulate; flowers narrowly tubular, 4-merous; aestivation contorted; stigma with 2, 3 or 4 lobes; ovary bi-, tri- or tetralocular with a single ovule per locule; fruits drupaceous; seeds with a large adaxial excavation (De Block 1998).

In Madagascar, *Ixora* is represented by c. forty species, a number that is slightly higher than for continental Africa (De Block 1998). All but two species, *I. platythyrsa* Baker and *I. cremixora* Drake, are endemic to the great island and no species are in common with Continental Africa. In the

past, fourteen Madagascan *Ixora* species were recognized by Arènes (1960), Baker (1885, 1890), de Candolle (1901), Drake del Castillo (1897a, 1897b), Hochreutiner (1908), Oliver (1892) and Guédès (1986). More recently, seven species were newly described (De Block 2007, 2008, 2014). As is the case with many Madagascan plant groups, a high number of species remain unnamed, but the author's revision of the Madagascan species is underway.

In comparison to continental Africa, *Ixora* has undergone a rare differentiation in Madagascar. Flower size varies greatly with corolla tubes between 0.4 and 23 cm long (De Block 2007). The number of flowers per inflorescence is also variable: six species have solitary flowers and several others are pauciflorous (De Block 2008), whereas in other parts of the distribution area most *Ixora* species have inflorescences with numerous flowers. Multilocular ovaries, a rare character within the genus, occur in four Madagascan species (De Block 2014). This character is correlated with the presence of large, thick-walled fruits and small seeds. However, large fruits also occur in other Madagascan *Ixora* species, such as *I. siphonantha* Oliv. (De Block 1998) or *I. foliicalyx* Guédès (De Block & Van De Kerckhove 2009). Despite this differentiation, several *Ixora* species in Madagascar are difficult to distinguish. Capuron (1973) wrote: “Le genre *Ixora* constitue, à Madagascar, un groupe très homogène, où la distinction des espèces devra se baser sur des caractères de faible importance tels que la taille des fleurs, forme et taille des lobes calicinaux, stipules etc. ...”.

In this paper, eight new species of *Ixora* are described, bringing the number of named species up to 29. Most of the new species are known from relatively few herbarium specimens. Recent collecting programmes from institutes such as Missouri Botanical Garden or Conservatoire et Jardin botaniques de Genève targeted undercollected regions, such as

Masoala Peninsula (MBG) or Antsiranana (G). This resulted in the collection of several new species previously not represented in herbaria, such as *I. fuscovenosa*, *I. gautieri* and *I. pallens*. These recent collecting activities also added precious herbarium material to other undescribed species previously only known from one or a few specimens, e.g. *I. pedalis*, *I. longipedicellata* and *I. masoalensis*, finally allowing their formal description. Intensive collecting clearly is still necessary in many regions in Madagascar. This is certainly the case for the Sambirano Region, two species of which are described here. *Ixora decaryi* is unfortunately only known from historical material, *I. longipedicellata* from a single historical and one recent specimen. Difficult access to the localities where they occur, e.g. Tsaratanana Mountain, is certainly a reason for the undercollecting.

## MATERIAL AND METHODS

Herbarium material of the following institutions was studied: BR, G, K, MO, P, TAN, TEF, UPS, WAG and Z. Extra plant material and alcohol preserved samples were collected during field work in Madagascar. Terminology follows Robbrecht (1988) but leaf shape is described according to the terminology of simple symmetrical plane shapes (Anonymous 1962). Methods follow normal practice of herbarium taxonomy (de Vogel 1987). In the descriptions, inflorescence size does not include the corollas. Colours and sizes are given for herbarium specimens (dried plant parts). Colours of the living plants are given separately. Flowering and fruiting periods are based on dates given on the labels of herbarium material.

Specimens are cited per province and alphabetically by collector. Localities are cited as given by the collectors on the specimen labels, with region added for information. Coordinates of localities were determined using the online Gazetteer to Malagasy Botanical Collecting Localities (Schatz et al. 2003). Also, 1:500.000 maps from the Malagasy Institut National de Géodésie et Cartographie were used. Distribution maps were drawn using Arcmap 9.2.

Abbreviations used: fiv., Fivondronana (district); fok., Fokotany (canton).

## TAXONOMIC TREATMENT

### *Ixora decaryi* De Block, sp. nov.

Foliarum laminis parvis et inflorescentias paucifloris sessilibus *Ixora microphylla* similis, sed ab ea specie removenda foliarum laminis apice obtusis vel subacuti (nec acuminatis), pedicellis brevioribus [0.2–2.5(–3) mm longis versus 2–12 mm], calycibus minoribus (0.8–1.5 mm longis versus 1.5–3.5 mm), corollae tubis lobisque brevioribus [tubis (0.5–) 0.8–1.1 cm longis versus (2.2–)2.8–4 cm; lobis 3.5–5.5 mm longis versus 7–12 mm] atque alabastris apice obtusis (vel rariore ± acutis versus acuminatis in *I. microphylla*). – Type: Madagascar, province Antsiranana, Sava, Maromandia, Bemanevika, 23 Sep. 1922, Decary 1032 (holo-: P).

Small shrub; young internodes brown, smooth; older internodes grey, corky or flaking; all external parts glabrous or, more rarely, young shoots, midribs below, stipules, in-

florescence axes, pedicels, bracts and bracteoles, ovaries, calyces and corollas moderately to densely covered with very short erect hairs (*Perrier de la Bâthie* 15058). Leaves mostly grouped terminally on short lateral shoots, petioles 0.2–0.4 cm long; blades elliptic, somewhat obovate or ovate, 1.5–4.2 × 0.6–2 cm, papery, drying brown above, greyish green to pale brown below; apex obtuse to subacute, base attenuate to cuneate; 7–10 pairs of lateral nerves, higher order venation coloured darker on lower leaf surface. Stipules: sheath 1–2 mm long, awn (1–)1.5–3.5 mm long. Inflorescences sessile or more rarely subsessile, lax, with 5–25 flowers, articulate throughout, 0.7–2.5 cm wide and 0.7–2.5 cm long; modified inflorescence-supporting leaves absent; central first order axis 0.2–1 cm long, lateral first order axes 0.4–1.5 cm long; first order bracts with stipular parts fused to an ovate blade with a central awn and foliar parts forming small leaves; higher order bracts with stipular parts reduced and foliar parts broadly (basally in inflorescence) to narrowly triangular (higher up in inflorescence) and vaulted or filiform (terminally in inflorescence), c. 1 mm long. Ultimate flower triads: flowers subsessile to shortly pedicellate; pedicels 0.2–2.5(–3) mm long, pedicels of central and lateral flowers not differing much in length; bracteoles usually present, opposite at the base of the ovary, narrowly triangular to filiform, up to 1(–2) mm long. Flowers: flower bud with obtuse or acute apex; calyx 0.8–1.5 mm long, tube up to 0.5 mm long, lobes triangular or narrowly triangular, 0.3–1 mm long, apices acute, smaller interstitial lobes sometimes present; corolla tube (5–)8–11 mm long; corolla lobes 3.5–5.5 mm long, 2–3 mm wide, apices blunt; stamens spreading at anthesis, filaments up to 1 mm long, anthers 3.5–4 mm long; ovary bilocular, c. 1 mm long; style exerted 3–4 mm, stigmatic lobes 1–2.5 mm long. Fruits slightly wider than high, bilobed, 0.7–0.8 cm wide, 0.6–0.7 cm long; fruit wall thin; mature seeds unknown. Fig. 1.

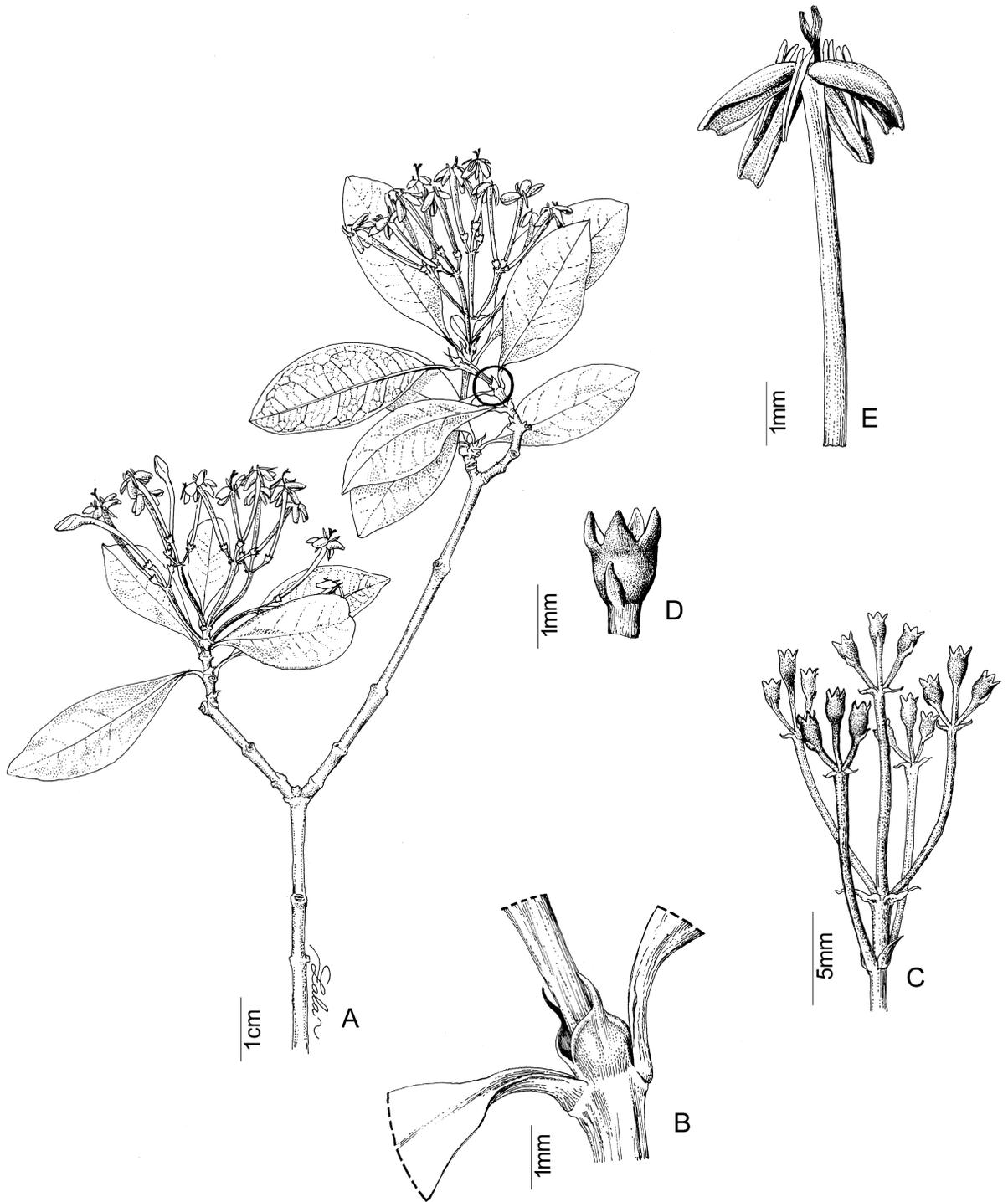
**Habitat** – Mid-altitude to montane humid forest, altitude: 700–1700 m.

**Distribution** – Only known from the Sofia and Diana Regions in northwestern Madagascar (provinces Antsiranana and Mahajanga). Fig. 2A.

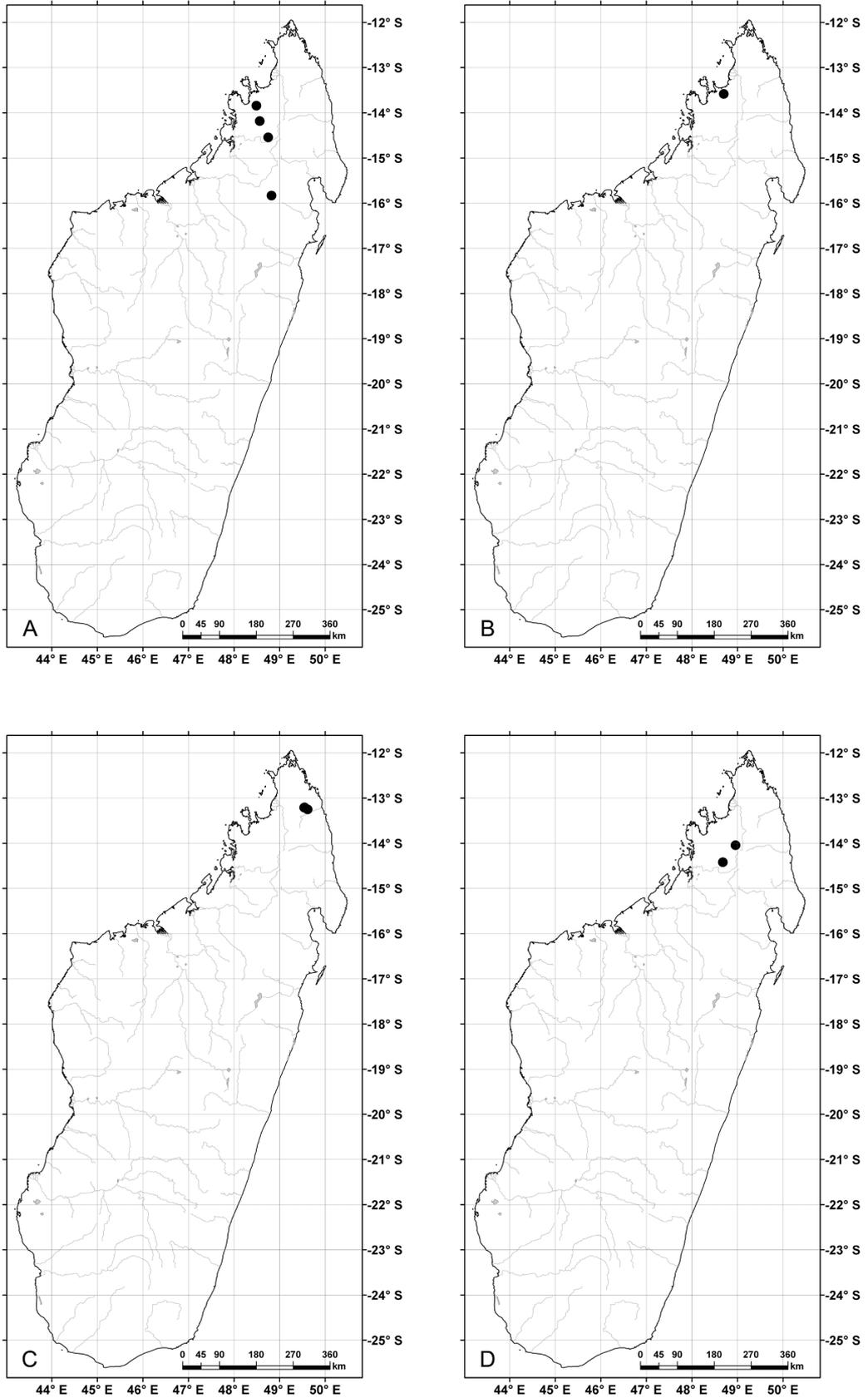
**Phenology** – Flowers: September; fruits: February.

**Living colours** – Corolla white or white tinged pink.

**Critical remarks** – This species is only known from four historical specimens. The most recent one was collected in 1951. Collecting efforts in the distribution area of this species should be undertaken in order to ascertain its conservation status. – All material of this species has glabrous vegetative and generative parts except for *Perrier de la Bâthie* 15058. In this specimen the young shoots, stipules, midribs on the lower leaf surfaces, inflorescence axes and pedicels, ovaries, calyces and corollas are moderately to densely covered with very short hairs. – The name *Ixora decaryi* is an unpublished name taken from herbarium collections at P (*Decary* 1057). The author of the name could not be determined. – *Ixora decaryi* is most likely to be confused with one of the other new species, *I. longipedicellata*, and with *I. microphylla*. These three species possess small to relatively small leaves, and few-flowered inflorescences. When flowering, the species are easily distinguishable from each other:



**Figure 1** – *Ixora decaryi*: A, flowering branch; B, stipules; C, inflorescence (corollas removed); D, bracteole, ovary and calyx; E, corolla, stamens, style and stigma (A–E, from *Perrier de la Bâthie* 15058). Drawn by Roger Lala Andriamiarisoa.



**Figure 2** – Distribution maps. A, *Ixora decaryi*; B, *Ixora fuscovenosa*; C, *Ixora gautieri*; D, *Ixora longipedicellata*.

**Table 1** – Distinguishing characters for *Ixora decaryi*, *I. longipedicellata* and *I. microphylla*.

	<i>I. decaryi</i>	<i>I. longipedicellata</i>	<i>I. microphylla</i>
Leaf blade	1.5–4.2 × 0.6–2 cm	1.2–3 × 0.6–1.5 cm	2.5–8.5 × 1.2–3.5 cm
Leaf apex	obtuse to subacute	obtuse to rounded	acuminate, acumen ≤ 1(–1.5) cm long or more rarely apiculate
Pedicel length	0.2–2.5(–3) mm	7–25 mm	2–12 mm
Flower bud apex	obtuse or acute	obtuse	acuminate
Calyx lobes	triangular or narrowly triangular, 0.3–1 mm long	oblong to somewhat foliaceous, (1–)1.5–2.5 mm long	triangular, 0.5–1.5 mm long
Corolla tube length	(5–)8–11 mm	4–5 mm	(22)–28–35(–40) mm
Corolla lobe length	3.5–5.5 mm	3–4 mm	7–12 mm

*I. microphylla*, by the long flowers with acuminate lobes; *I. longipedicellata*, by the small flowers (corolla tube 4–5 mm long) with blunt corolla lobes, the oblong to somewhat foliaceous calyx lobes up to 2.5 mm long and the long pedicels; and, *I. decaryi*, by the flowers of intermediate length [corolla tubes (5–)8–11 mm long] (table 1). The leaves of *I. microphylla* differ from those of both other species by their somewhat larger size and by the acuminate or apiculate apex. While the three species occur in the same region, northwestern Madagascar, *I. microphylla* is a lowland species with a preference for calcareous soil, whereas the known specimens of *I. decaryi* and *I. longipedicellata* have a submontane to montane distribution.

**Other collections examined** – Madagascar: *Mahajanga*: Sofia, Maromandia, Sandrakota, 23 Sep. 1922, *Decary* 1057 (P); Sofia, de la Haute Maevarano au Bas Sambirano par Bealanana et la Haute Sandrakota, 20–25 Feb. 1951, *Humbert & Capuron* 25432 (K, P); Sofia, environs de Mandritsara, Sep. 1922, *Perrier de la Bâthie* 15058 (P).

### *Ixora fuscovenosa* De Block, *sp. nov.*

*Ixora emirnensis* ob inflorescentias pedunculatas corollae tubis potius brevibus similis, sed notabilis calycis tubis lobisque multo longioribus (1.5–2 mm longis versus 0.3–0.4 mm), corolla tubis alignot longioribus (25–28 mm longis versus 10–15 mm) et alabastris apice acuminatis. – Type: Madagascar, Province Antsiranana, Diana, Ambilobe, commune rurale Beramanja, Chaîne Galoka, mont Galoke, fok. Anketrabe-Belinta, Galoka relevé 1, 18 Feb. 2005, *Wohlhauser, Tonga, Ravokatra, Lang, Manasse, Claude & Bocksberger* 741 (holo-: G; iso-: BR, K, MO, P, TAN).

**Shrub**, to 4 m tall; young internodes brown, smooth; older internodes greyish or greyish brown, corky; all external parts glabrous, except for peduncle and inflorescence axes which may be glabrous or sparsely to moderately covered with very short hairs. **Leaves**: petioles 0.4–0.8 cm long; blades elliptic or obovate, 8–12 × 2–4 cm, papyraceous, drying brown above, somewhat paler below; apex acuminate with acumen 0.8–2 cm long; base cuneate or acute; 12–18 pairs of lateral nerves, higher order venation coloured darker and somewhat raised on lower leaf surface. **Stipules**: sheath 1.5–2.5 mm long, awn 2–5 mm long. **Inflorescences** pedunculate, lax, with 5–18 flowers, articulate throughout, 4–6 cm wide and 2–3 cm long; modified inflorescence-supporting

leaves present, blades sessile to shortly petiolate (petioles up to 2 mm long), elliptic to obovate, 2–4 × 1.5–2 cm, base cordate to rounded; peduncle 2–3 cm long; central first order axis 1–2 cm long, lateral first order axes 1.5–3 cm long; first order bracts with stipular parts absent and foliar parts triangular and vaulted; higher order bracts with stipular parts absent and foliar parts narrowly triangular, up to 2 mm long. **Ultimate flower triads**: flowers subsessile to shortly pedicellate; pedicels 0.5–2 mm long or up to 5 mm long in case of reduction, pedicels of central and lateral flowers not differing much in length; bracteoles present, opposite at the base of the ovary or somewhat lower on the pedicel, filiform, 0.5–1.25 mm long. **Flowers**: flower bud with acuminate apex; calyx 2.5–3.5 mm long, tube c. 1.5 mm long, lobes oblong or slightly foliaceous, somewhat keeled, 1.5–2 mm long, apices obtuse to rounded; corolla tube 25–30 mm long; corolla lobes 8–9 mm long, c. 3 mm wide, apices acuminate; stamens spreading at anthesis, filaments 1–1.5 mm long, anthers 2.5–3 mm long; ovary bilocular, c. 1 mm long; style exerted 2–3 mm, stigmatic lobes 0.75–1 mm long. **Fruits**: mature fruits and seeds unknown. Fig. 3.

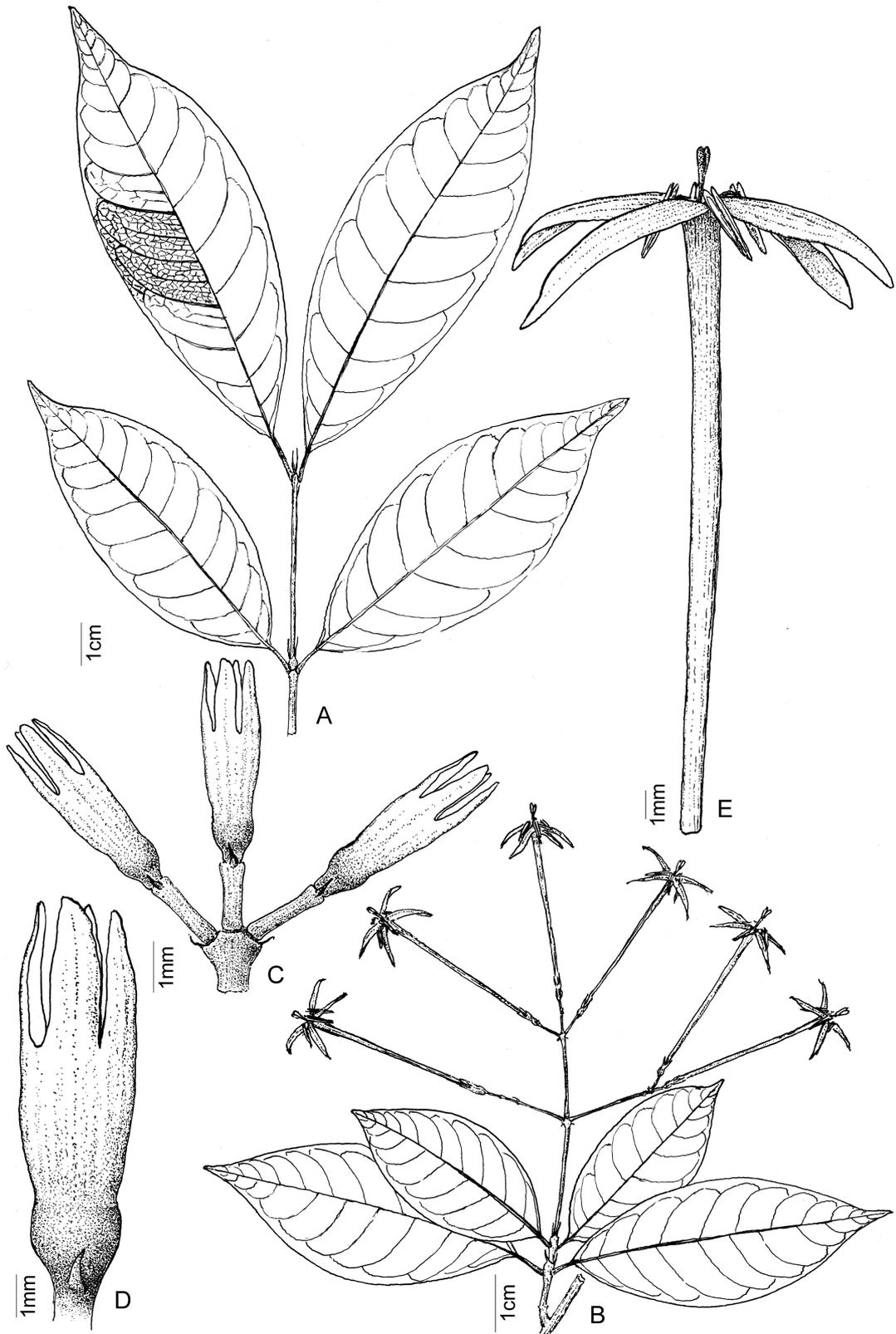
**Habitat** – Low-altitude evergreen humid forest, altitude: c. 300 m.

**Distribution** – Only known from the Chaîne Galoka region near Ambilobe (province Antsiranana). Fig. 2B.

**Phenology** – Flowers and young fruits: February.

**Living colours** – Peduncle, inflorescence axes, pedicels, bracts and bracteoles red; ovary red, calyx whitish; corolla white; anthers and filaments white; style white (based on photographs by S. Wohlhauser).

**Critical remarks** – This species is only known from the type. As a result the description may need to be updated when more material becomes available. – In dried condition, the higher order venation is somewhat raised and coloured darker than the lower leaf surface, hence the species epithet. – *Ixora fuscovenosa* is characterized by relatively small leaves, pedunculate inflorescences with a moderate number of flowers and relatively short corolla tubes, just as *I. gautieri*, *I. pallens*, *I. emirnensis* Baker and *I. mangabensis* Aug. DC. Amongst these species, *I. fuscovenosa* is recognized by the long calyx tube (c. 1.5 mm) and leaf-like, keeled calyx lobes 1.5–2 mm long, the long stipular awns (2–5 mm long) and acuminate flower buds and corolla lobes (table 2).



**Figure 3** – *Ixora fuscovenosa*: A, vegetative branch; B, flowering branch; C, ultimate flower triad (corollas removed); D, bracteole, ovary and calyx; E, corolla, stamens, style and stigma (A–E, from Wohlhauser *et al.* 741). Drawn by Antonio Fernandez.

**Table 2** – Distinguishing characters for *Ixora fuscovenosa*, *I. pallens*, *I. gautieri*, *I. emirnensis* and *I. mangabensis*.

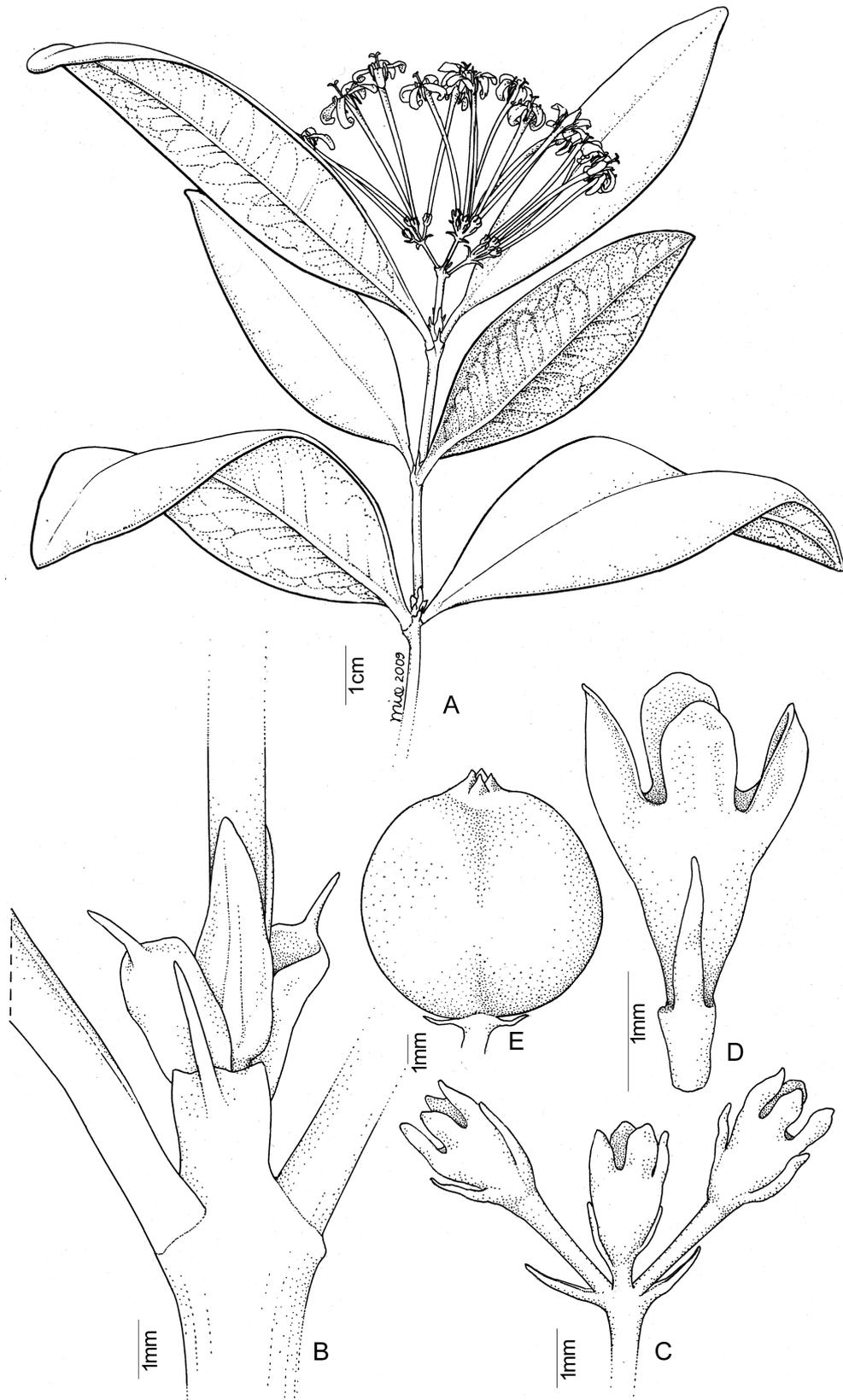
	<i>I. fuscovenosa</i>	<i>I. pallens</i>	<i>I. gautieri</i>	<i>I. emirnensis</i>	<i>I. mangabensis</i>
Pubescence of peduncle and inflorescence axes	present or absent	absent	absent	absent	present or absent
Petiole length	0.4–0.8 cm	0.6–1.5 cm	0.1–0.2(–0.4) cm	0.2–1(–1.5) cm	0.1–0.7 cm
Leaf base	cuneate or acute	cuneate or rarely acute	acute to cuneate	cuneate to acute or rounded, rarely attenuate	acute, obtuse, rounded or cordate
Leaf blade colour	brown	pale greenish or pale brownish	brown	(dark) brown	(dark) brown
Leaf blade texture	papyraceous	papyraceous	strongly coriaceous	papyraceous or subcoriaceous	papyraceous, more rarely coriaceous
Leaf blade apex	acuminate, acumen 0.8–2 cm long	acuminate, acumen 0.4–1.6 cm long	obtuse	acuminate, acumen up to 1 cm long	acuminate, acumen 0.4–2 cm long
Higher order veins	darker on lower leaf surface	not discolourous	not discolourous	darker on lower leaf surface	darker on lower leaf surface
Stipular awn length	2–5 mm	0.5–1(–2) mm	1–2 mm	1–3 mm	1.5–6 mm
Peduncle length	2–3 cm	6–8 cm	0.1–1.2 cm	2–10 cm	1.5–16 cm
Pedicel length	0.5–2(–5) mm	2–8 mm, up to 15 mm in fruit	0.5–3 mm	0–3 mm	1–4(–7) mm
Bracteoles	filiform, 0.5–1.25 mm long	filiform, 0.5–1 mm long	narrowly triangular, 1–1.5 mm long	filiform, 0.25–0.8 mm long	filiform, 0.5–2.2 mm long
Calyx tube length	c. 1.5 mm	0.2–0.4 mm	0.5–0.6 mm	0.2–0.3 mm	0.2–0.5 mm
Calyx lobes	oblong or slightly foliaceous, 1.5–2 mm long	broadly triangular or broadly ovate, 0.3–0.5 mm long	ovate or broadly ovate, 0.8–1.2 mm long	triangular, 0.3–0.4 mm long	triangular or narrowly triangular, 0.5–1 mm long
Calyx lobes apices	obtuse to rounded	rounded	rounded	obtuse to rounded	acute
Corolla tube length	2.5–3 cm	2–2.6 cm	2.2–2.6 cm	1–1.5 cm	2–2.6(–3.2) cm
Corolla lobes length	0.8–0.9 cm	0.6–0.7 cm	0.4–0.7 cm	0.3–0.5 cm	0.5–0.7 cm
Filament length	1–1.5 mm	0.5–1 mm	1–1.5 mm	0.7–1 mm	c. 0.5 mm
Flower bud	acuminate	obtuse	rounded	acute	acuminate

***Ixora gautieri* De Block, sp. nov.**

*Ixora fuscovenosa* similis inflorescentiis breviter pedunculatis, foliarum laminis potius parvis et calycis lobis potius longis, sed ab illa differt foliarum laminis valde coriaceis et apice obtusis; praeterea inflorescentiis congestioribus et alabastris apice rotundis bene diagnoscenda. – Type: Madagascar, province Antsiranana, Sava, sous-préfecture de Vohemar, commune rurale Daraina, Daraina, forêt d’Antsahabe, 880 m du point côté 1088, 20 Nov. 2004, *Gautier* 4705 (holo-: G; iso-: BR).

**Shrub**, 2–4 m tall; young internodes brown, smooth; older internodes greyish or brown, corky; all external parts glabrous. **Leaves**: petioles 0.1–0.2(–0.4) cm long; blades elliptic or broadly elliptic, more rarely somewhat ovate or obovate, 3–8 × 1.2–3.5 cm, strongly coriaceous, drying brown and somewhat glossy above, brown below; apex obtuse; base acute to cuneate; 11–13 pairs of lateral nerves; secondary and higher order venation somewhat raised on both surfaces. **Stipules**: sheath 1–2 mm long, awn 1–2 mm long. **Inflorescences** shortly pedunculate or more rarely subsessile, moderately compact, with 15–30 flowers, articulate throughout except sometimes between ovary and pedicel; 1–2.5 cm wide

and 1–2 cm long; modified inflorescence supporting leaves present, blades subsessile, not differing in shape from vegetative ones, 0.4–1.5 × 0.15–0.7 cm; peduncle 0.1–1.2 cm long; central first order axis 0.1–1 cm long, lateral first order axes 0.4–1.8 cm long; first order bracts with stipular parts reduced or absent and foliar parts narrowly triangular and vaulted, up to 2 mm long (in pedunculate inflorescences), or more rarely (in subsessile inflorescences) stipular parts fused to an ovate sheath with a central awn and foliar parts forming small leaves; higher order bracts with stipular parts absent, foliar parts narrowly triangular, 1.5–2 mm long. **Ultimate flower triads**: flowers subsessile to shortly pedicellate; pedicels 0.5–3 mm long, pedicels of central flowers often somewhat shorter than those of lateral flowers; bracteoles present, opposite at the base of the ovary, narrowly triangular, 1–1.5 mm long. **Flowers**: flower bud with rounded apex; calyx 1.2–2 mm long, drying paler than the ovary, tube 0.5–0.6 mm long, lobes ovate or broadly ovate, often somewhat unequal within one flower, 0.8–1.2 mm long, apices rounded; corolla tube 22–26 mm long; corolla lobes 4–7 mm long, 3–3.5 mm wide, apices blunt; stamens spreading at anthesis, filaments 1–1.5 mm long, anthers 3–4 mm long; ovary bilocular, c. 0.8 mm long, drying blackish; style exerted



**Figure 4** – *Ixora gautieri*: A, flowering branch; B, node below inflorescence, showing stipules and petioles of vegetative leaf pair, stipules and small leaf blades of inflorescence-supporting leaves and base of peduncle; C, ultimate flower triad (corollas removed); D, bracteole, ovary and calyx; E, fruit (A–D, from Gautier 4705; E, from Ranirison & Nusbaumer 1140). Drawn by Mia Scheerlinck.

3.5–4 mm, stigmatic lobes 1–1.5 mm long. **Fruits** bilobed; mature fruits and seeds unknown. Fig. 4.

**Habitat** – Mid-altitude forest, often on mountain ridges, altitude: 900–1060 m.

**Distribution** – Only known from the region of Daraina in northern Madagascar (province Antsiranana). Fig. 2C.

**Phenology** – Flowers: November; fruits: immature fruits recorded in January.

**Living colours** – Corolla white, tips of corolla lobes pink in bud.

**Critical remarks** – *Ixora gautieri* resembles *I. fuscovenosa* and other species by the relatively small leaves, the pedunculate inflorescences with a moderate number of flowers and the relatively short corolla tubes. Amongst these species, *I. gautieri* can be differentiated by the strongly coriaceous leaves with obtuse tips, by the not-discolourous higher order venation, and by the rounded tips of the flower buds (table 2).

**Other collections examined** – **Madagascar: Antsiranana:** Sava, sous-préfecture de Vohemar, commune rurale Daraina, fok. Anki-jabe, forêt de Binara, camp 1, 1.8 km SW du camp, 10 Nov. 2001, *Gautier & Ravelonarivo* 4158 (BR, G); Sava, sous-préfecture de Vohemar, commune rurale Daraina, Daraina, forêt d'Antsahabe, 550 m du point côté 1099, 29 Jan. 2006, *Ranirison & Nusbaumer* 1140 (BR, G).

#### *Ixora longipedicellata* De Block, **sp. nov.**

Foliis parvis et inflorescentiis paucifloris laxis *Ixora microphylla* affinis, sed differt corollae tubis lobisque multo brevioribus (tubis 4–5 mm longis versus 22–40 mm in *I. microphylla*; lobis 3–4 mm longis versus 7–12 mm), alabastris apice obtusis (versus acuminatis) et foliorum laminis obtusis vel rotundis (versus acuminatis). – Type: Madagascar, Province Mahajanga, Betsiboka, environs de Montagne de Tsaratanana, Sep. 1912, *Perrier de la Bâthie* 3745 (holo-: P; iso-: P).

**Shrub**; young internodes brown, smooth, sparsely to moderately covered with short erect hairs; older internodes greyish, corky; all external parts glabrous except for young internodes, inflorescence axes and pedicels. **Leaves** grouped terminally on short lateral shoots; petioles 0.1–0.3 cm long; blades obovate or broadly obovate, 1.2–3 × 0.6–1.5 cm, papyraceous, drying brownish above, paler brown or greyish green below; apex obtuse to rounded; base cuneate; 5–8 pairs of lateral nerves. **Stipules** caducous; sheath c. 1 mm long, awn 1.5–5 mm long (only visible in youngest stipule pairs). **Inflorescences** sessile, very lax, with 3–5(–9) flowers, articulate throughout, 2.5–5 cm wide and 1.2–3 cm long; modified inflorescence-supporting leaves absent; inflorescence axes sparsely to moderately covered with short erect hairs; central first order axis 0.2–0.6 cm long, lateral first order axes 1–2.5 cm long; first order bracts with stipular parts fused to an ovate sheath with a central awn and foliar parts absent or forming small leaves; higher order bracts either as first order bracts but somewhat reduced or with stipular parts absent and foliar parts triangular and vaulted, somewhat fimbriate or filiform, up to 2 mm long. **Ultimate flower triads**: flowers long pedicellate; pedicels 7–25 mm long; pedicels of central and lateral flowers not differing much in length;

bracteoles present, opposite on the pedicel below the ovary, more rarely at the base of the ovary, filiform, 1–2 mm long. **Flowers**: flower bud with obtuse apex; calyx 1.5–2.75 mm long, tube c. 0.3 mm long, lobes oblong to somewhat foliaceous, (1–)1.5–2.5 mm long, apices obtuse to rounded; corolla tube 4–5 mm long; corolla lobes 3–4 mm long, c. 2 mm wide, apices obtuse; stamens spreading at anthesis, filaments 1–1.5 mm long, anthers c. 2.5 mm long; ovary bilocular, c. 1 mm long, drying dark brown or blackish; style exerted 3–4.5 mm, stigmatic lobes 1.25–2 mm long. **Fruits** subglobose, 0.4–0.5 cm in diameter; fruit wall thin; seeds unknown. Fig. 5.

**Habitat** – Forest, altitude: 1100–1350 m.

**Distribution** – Only known from the Sofia and Betsiboka Regions (province Mahajanga). Fig. 2D.

**Phenology** – Flowers: September – November; fruits: September.

**Living colours** – Corolla white; fruits red.

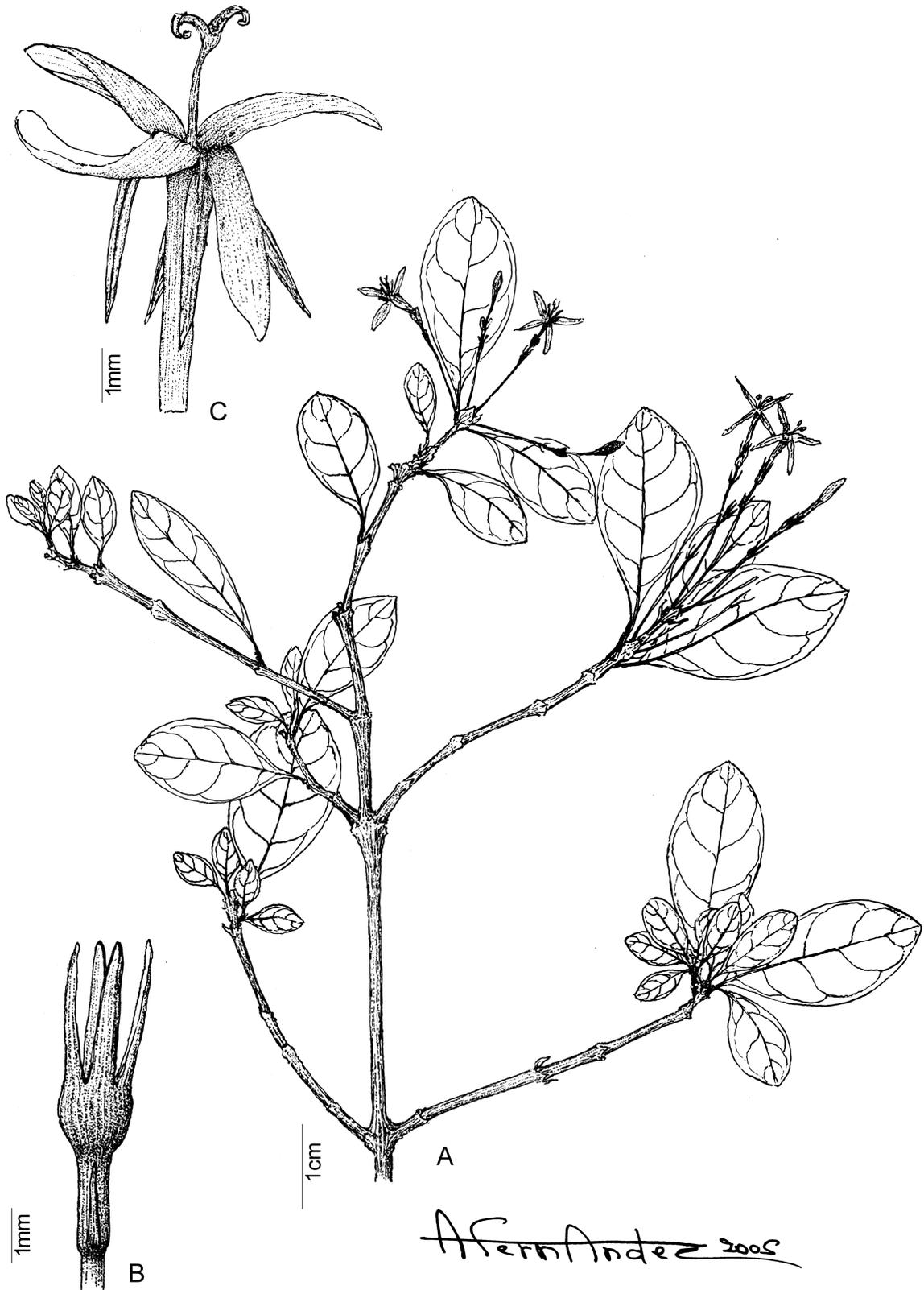
**Critical remarks** – The specimen collected by Perrier de la Bâthie was annotated as *I. longipedicellata* in P, but no author is indicated and the name was never published. – The fruit dimensions given here are provisional. Although Perrier de la Bâthie indicated the fruits as red, i.e. mature, they seem very small for *Ixora*. Since there is only one fruit available, the maturity could not be checked. – For almost one hundred years the type specimen was the only material known for *I. longipedicellata*. Only recently a second specimen was collected, indicating that this species is not extinct. – *I. longipedicellata* can be confused with *I. decaryi* and *I. microphylla*, both species with small leaves and few-flowered inflorescences. Table 1 gives the characters to distinguish them.

**Other collections examined** – **Madagascar: Mahajanga:** Sofia, Bealanana, forêt de moyenne altitude située à 7 km NE de la commune rurale de Mangindrano, Nov. 2005, *Rakotovo* 2606 (BR, MO, P, TAN).

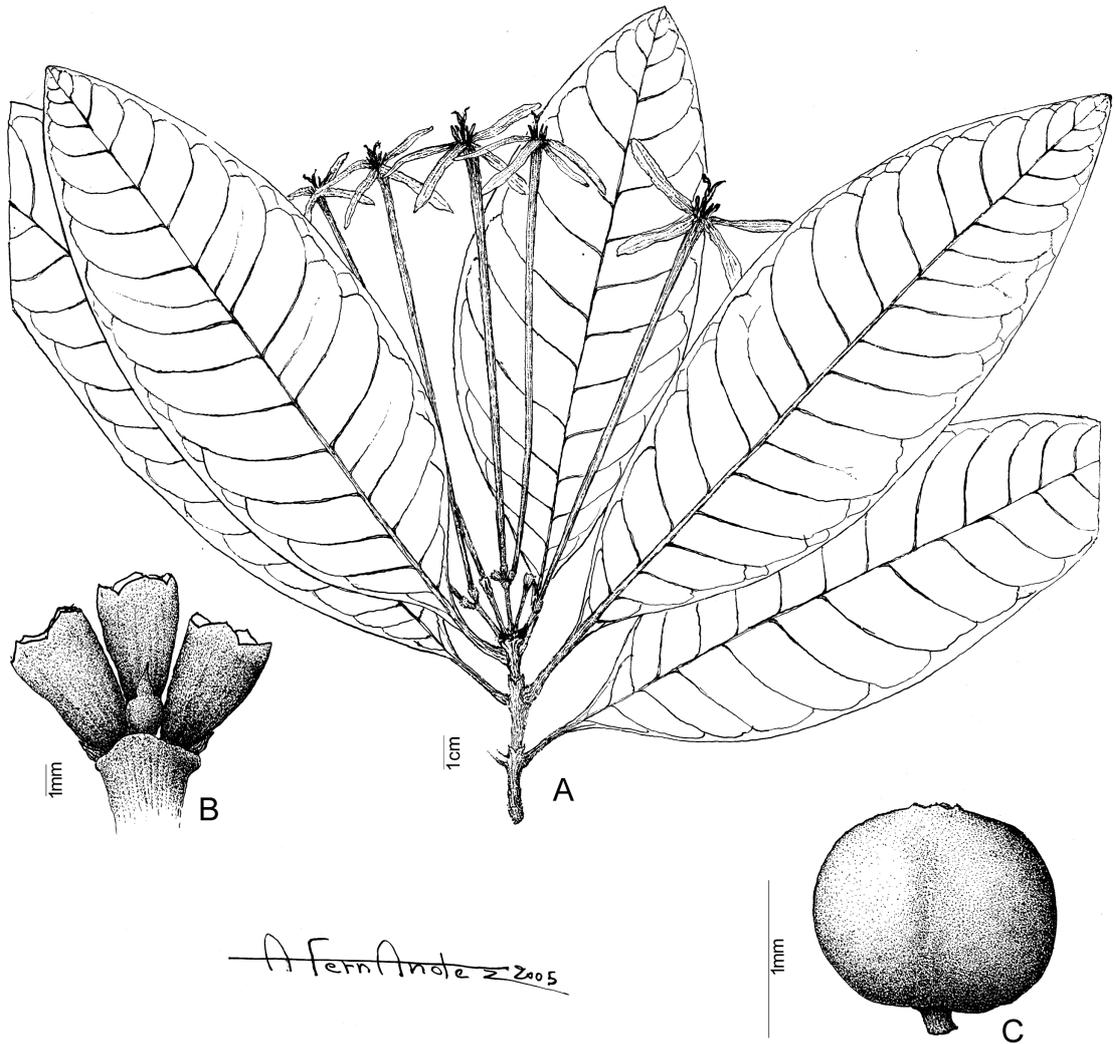
#### *Ixora masoalensis* De Block, **sp. nov.**

Foliarum laminis magnis crassisque in sicco stramineis *Ixora crassipedi* affinis, a qua differt corollarum tubis brevioribus (10–12 cm longis versus 17–22.5 cm) et inflorescentiis paucifloris solummodo 8–25 (versus 15–50) floribus munitis. – Type: Madagascar, Province Toamasina, Analanjirofo, Masoala Peninsula, north trail, N of Androka River, climbing hills E of Ambanizana, 17 Dec. 1990, *Schatz & Modeste* 3068 (holo-: MO; iso-: K, P, TAN).

**Shrub** or tree, 0.5–7 m tall; young internodes orange or reddish brown, smooth, older internodes dark brown, somewhat corky; all external parts glabrous. **Leaves**: petioles 1–2.5 cm long; blades ovate or elliptic to narrowly elliptic, 15–30 × 4.5–11.5 cm, coriaceous or subcoriaceous, drying yellowish or pale greenish above, somewhat paler below; apex obtuse to acute; base attenuate; 14–25 pairs of lateral nerves. **Stipules**: sheath 3–4 mm long, awn very short, hardly exceeding sheath. **Inflorescences** sessile, lax, with 8–25 flowers, articulate throughout, 1.5–6 cm wide and 2–4 cm long; modified inflorescence-supporting leaves absent; central first order axis 0.1–1 cm long, lateral first order axes



**Figure 5** – *Ixora longipedicellata*: A, flowering branch; B, bracteole, ovary and calyx; C, corolla, stamens, style and stigma (A–C, from Perrier de la Bâthie 3745). Drawn by Antonio Fernandez.



**Figure 6** – *Ixora masoalensis*: A, flowering branch; B, ultimate flower triad (corollas removed); C, fruit (A & B, from Schatz & Modeste 3068; C, from Zjhra & Hutcheon 323). Drawn by Antonio Fernandez.

0.5–2.5 cm long; first (and sometimes also second) order bracts with stipular parts fused into a blade with central awn and foliar parts absent or forming small leaves; higher order bracts with stipular parts absent, foliar parts triangular and vaulted, or, higher up in the inflorescence, fimbriate or linear. **Ultimate flower triads**: flowers sessile to shortly pedicellate; pedicels 0–1(–1.5) mm long, up to 15 mm long in case of reduction, pedicels of central and lateral flowers not differing much in length; bracteoles usually present, opposite at the base of the ovary, narrowly triangular to filiform, up to 1 mm long. **Flowers**: flower bud with rounded apex; calyx c. 1 mm long, tube 0.5–0.8 mm long, lobes triangular, somewhat unequal, 0.3–0.6 mm long, apices acute, obtuse or rounded; corolla tube 10–12 cm long; corolla lobes 1.7–3 cm long, 0.3–0.4 cm wide; apices rounded; stamens sessile, anthers not spreading at anthesis but remaining erect (their bases included in the corolla tube over a length of c. 4 mm), 8–11 mm long; ovary bilocular, c. 2 mm long; style exserted 7–10 mm, stigmatic lobes 2.5–5 mm long. **Fruits** subglobose, slightly wider than high, bilobed, 1.1–1.3 cm wide, 1–1.2 cm

long; fruit wall thin; seeds c. 0.85 cm long, c.0.6 cm wide. Fig. 6.

**Habitat** – Lowland humid eastern forest, altitude: 200–700 m.

**Distribution** – Northern Madagascar. Known from the Sambava-Marojejy region and from Masoala Peninsula (provinces Antsiranana and Toamasina). Fig. 7A.

**Phenology** – Flowers: October – February; fruits: May – June.

**Living colours** – Ovary and calyx green, sometimes calyx lobes tinged reddish near margin; corolla greenish near the base, white higher up; stamens white; style and stigma white. Flowers fragrant.

**Vernacular names** – Vongabe; vorigo.

**Critical remarks** – *Ixora masoalensis* is similar to *I. craspipes* Boivin ex De Block by the large, pale-drying, coriaceous leaves, the short-awned stipules, the robust inflorescence axes, the small ovaries and reduced calyx, bracts and

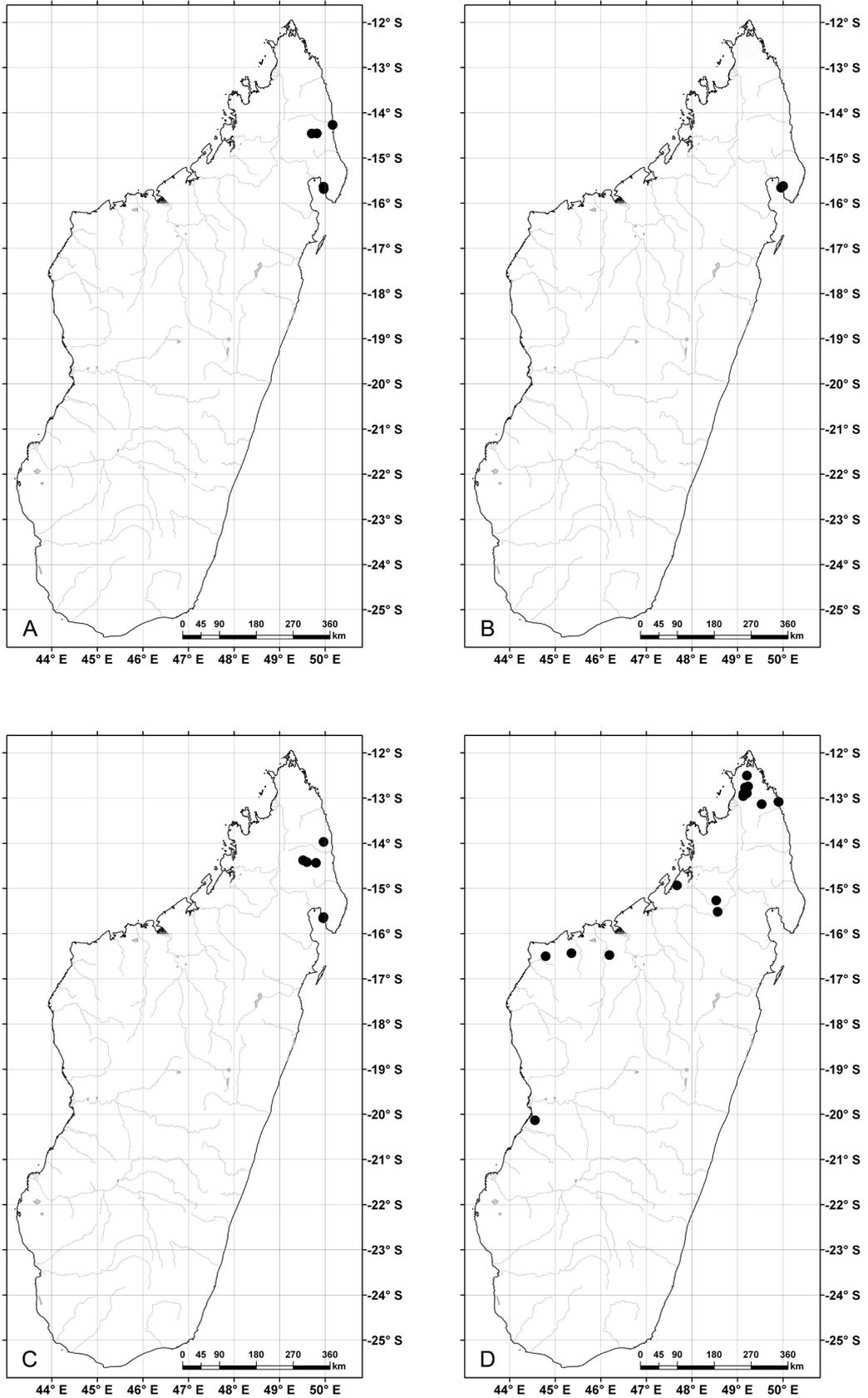


Figure 7 – Distribution maps. A, *Ixora masoalensis*; B, *Ixora pallens*; C, *Ixora pedalis*; D, *Ixora ripicola*.

**Table 3 – Distinguishing characters for *Ixora masoalensis* and *I. crassipes*.**

	<i>I. masoalensis</i>	<i>I. crassipes</i>
Leaf apex	obtuse to acute	shortly acuminate, acumen 0.5–1 cm long
Leaf base	attenuate	cuneate, acute, rounded
Inflorescences	articulate throughout, 1.5–6 cm wide, 2–4 cm long	not articulate just below the ovary, 9–13 cm wide, 6–9 cm long
Pedicle length	0–1(–1.5) mm	(2–)5–15 mm long
Bracteoles	usually present, filiform, up to 1 mm long	usually absent, if present, then filiform, < 0.5 mm long
Calyx	with triangular lobes, 0.3–0.6 mm long	truncate
Corolla tube	10–12 cm long	17–22.5 cm long
Stamens	erect at anthesis, sessile, anthers 8–11 mm long	spreading at anthesis, filaments 2–3 mm long, anthers 6–8 mm long

bracteoles. The two species differ in e.g. inflorescence size, articulation in the inflorescence, corolla tube length, pedicel length, presence/absence and size of bracteoles, size and position of stamens (table 3).

**Other collections examined – Madagascar:** *Antsiranana*: Sava, Sambava, 21 May 1956, *coll. ignot.* 7963-RN (P); Sava, district Sambava, canton Maroambihy, Andranomadiokely, 16 Jun. 1957, *coll. ignot.* 9007-RN (P); Sava, Sambava, 21 May 1956, *coll. ignot.* 17593-SF (P); Sava, Ambatomenavava, Bezavona, forêt d'Ampiranaomby, 25 Oct. 2010, *Ravelonarivo & Raharivelo* 3581 (BR, MO, P, TAN); Sava, district Andapa, Parc National de Marojejy, near entrance of park, 4 Feb. 2006, *Razafimandimbison & Ravelonarivo* 654 (S, TAN). – *Toamasina*: Analanjirofo, Maroantsetra, Parc National de Masoala, piste de Tampolo à l'ICOS II, Ambodiforaha, 22 Nov. 2001, *Sauquet, Rabevohitra & Rakotonasolo* 52 (P); Analanjirofo, Masoala Peninsula, Ambanizana, trail A behind MBG House, Jun. 1993, *Zjhra & Hutcheon* 323 (MO, P).

### *Ixora pallens* De Block, *sp. nov.*

*Ixora emirnensi* similis ob inflorescentias potius paucifloras, ovaria calycesque parvos, sed ab illa differt pedicellis longioribus (2–8 mm longis versus 0–3 mm), corollarum tubis lobisque etiam longioribus (tubis 2–2.6 cm longis versus 1–1.5 cm; lobis 0.6–0.7 cm longis versus 0.3–0.5 cm) atque foliarum laminis in sicco pallescentibus. – Type: Madagascar, Province Toamasina, Analanjirofo, Masoala Peninsula, south trail, S of Androka River, climbing into hill SE of Ambanizana, 30 Dec. 1990, *Schatz & Modeste* 3106 (holo-: MO; iso-: P, TAN).

**Shrub**, 1–3 m tall; young internodes brown, smooth; older internodes dark brown, smooth; all external parts glabrous. **Leaves**: petioles 0.6–1.5 cm long; blades elliptic or more rarely narrowly elliptic, 6.5–14 × 2.5–5 cm, papery, drying pale greenish or pale brownish above, somewhat paler below; apex acuminate with acumen 4–16 mm long; base cuneate or rarely acute; 10–20 pairs of lateral nerves. **Stipules** caducous, sheath 3–4 mm long, awn 0.5–1(–2) mm long. **Inflorescences** pedunculate, lax, with 20–30 flowers, articulate except sometimes between ovary and pedicel, 6–8 cm wide and 3–4.5 cm long; modified inflorescence-supporting leaves present, blades subsessile (petioles 1–2 mm long), elliptic to oblong, 0.8–2 × 0.2–0.8 cm, base obtuse to rounded; peduncle 6–8 cm long; central first order axis 0.5–1.8 cm long, lateral first order axes 1.5–

2.2 cm long; first order bracts with stipular parts absent and foliar parts triangular or fimbriate, up to 2 mm long; higher order bracts with stipular parts absent and foliar parts narrowly triangular, up to 1 mm long. **Ultimate flower triads**: flowers pedicellate; pedicels 2–8 mm long but up to 15 mm long in fruiting material, pedicels of central and lateral flowers not differing much in length; bracteoles usually present, opposite or sometimes sub-opposite at the base of the ovary or somewhat lower on the pedicel, filiform, 0.5–1 mm long. **Flowers**: flower bud with obtuse apex; calyx 0.6–0.8 mm long, tube 0.2–0.4 mm long, lobes broadly triangular or broadly ovate, somewhat keeled, 0.3–0.5 mm long, apices rounded; corolla tube 20–26 mm long; corolla lobes 6–7 mm long, c. 3 mm wide, apices blunt; stamens spreading at anthesis, filaments 0.5–1 mm long, anthers 2–2.5 mm long; ovary bilocular, 0.8–1 mm long; style exerted c. 2 mm, stigmatic lobes 0.8–1 mm long. **Fruits** slightly wider than high, bilobed, 0.8–1.2 cm wide and 0.9–1 cm long; fruit wall thin; seeds c. 8.5 mm long and 6.5 mm wide. Fig. 8.

**Habitat** – Low and mid-altitude evergreen humid eastern forest, altitude: 0–700 m.

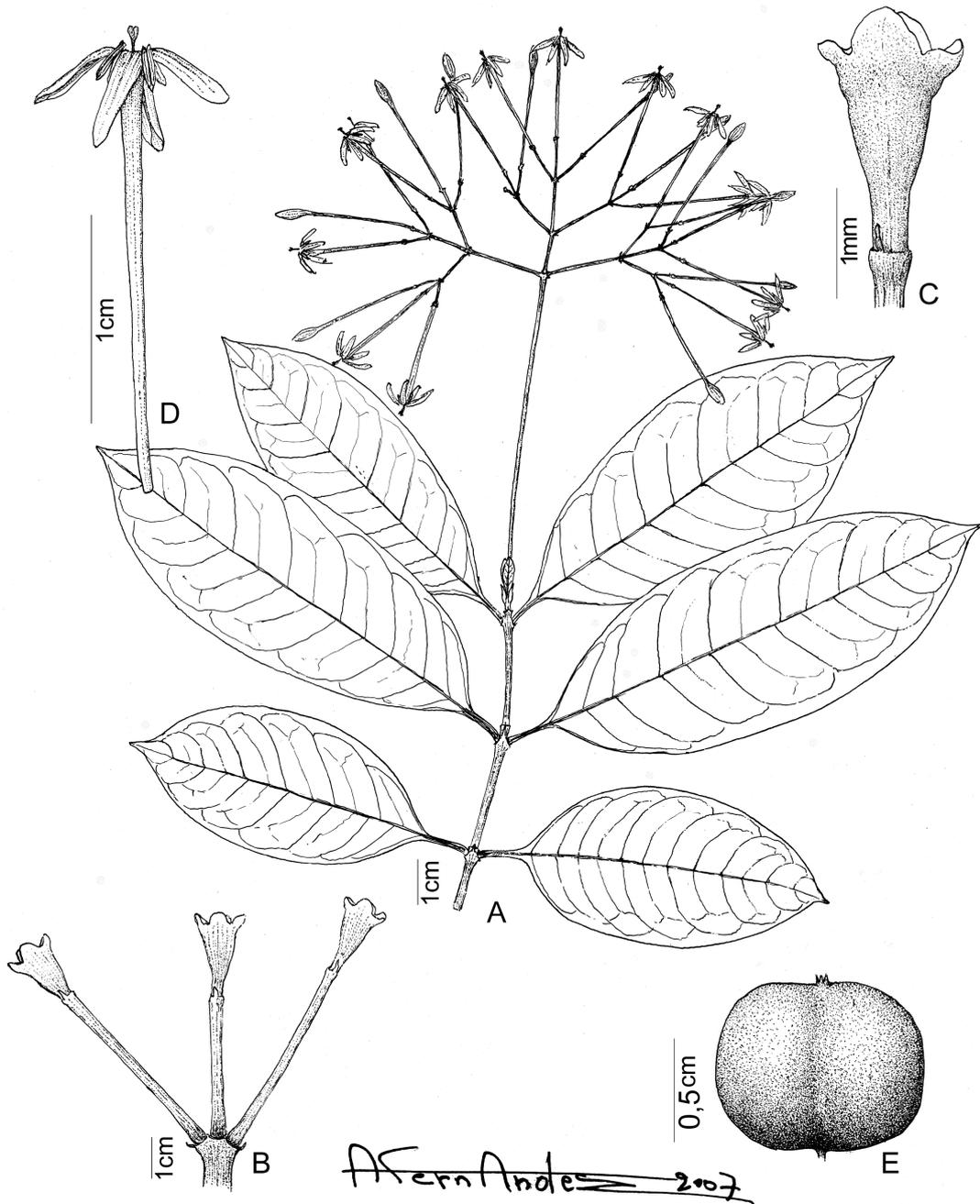
**Distribution** – Only known from the Masoala Peninsula (province Toamasina). Fig. 7B.

**Phenology** – Flowers: December – January; fruits: June – August.

**Living colours** – Peduncle, inflorescence axes, pedicels, bracts and bracteoles green; corolla white; ovary and calyx green; fruits red.

**Critical remarks** – The species epithet refers to the pale colour of the dried specimens. – Another species with relatively small leaves, pedunculate inflorescences with a moderate number of flowers and relatively short corolla tubes, *I. pallens* distinguishes itself by the pale drying colour of the leaves, the not-discolourous higher order venation, the obtuse flower bud and the relatively long pedicels (table 2).

**Other collections examined – Madagascar:** *Toamasina*: Analanjirofo, Parc National de Masoala, sur la route d'Ambanizana à Analambolo, 25 km N de la ville d'Ambanizana, c. 6 km NE d'Ambanizana, fiv. Maroantsetra, 24 Jan. 1996, *Aridy, Rahajaso & Moïse* 76 (MO, P); Analanjirofo, Ambanizana, Masoala Peninsula, trail A behind MBG house, Jun. 1993, *Zjhra & Hutcheon* 325 (MO, P); Analanjirofo, Ambanizana, Masoala Peninsula, along Androka River, S of MBG house, Jun. 1993, *Zjhra & Hutcheon* 377 (MO);



**Figure 8** – *Ixora pallens*: A, flowering branch; B, ultimate flower triad (corollas removed); C, bracteole, ovary and calyx; D, corolla, stamens, style and stigma; E, fruit (A–D, from Schatz & Modeste 3106; E, from Zjhra & Hutcheon 391). Drawn by Antonio Fernandez.

Analanjirifo, Andronobe, Masoala Peninsula, transect 2, 0–3 km E from coast, Jun.–Aug. 1993, Zjhra & Hutcheon 391 (MO, P).

***Ixora pedalis* De Block, sp.nov.**

Ab plerisque alteris speciebus Madagariensibus habitu suffruticoso (plantae solummodo 25 cm altae) et inflorescentiis paucifloris primo adpectu differt; praeterea foliorum laminis potius magnis [(5–)6.8–15 × 1.5–5.5 cm], floribus parvis (tubis 0.4–1.2 cm longis) et staminum filamentis longis (2 mm longis) singularis. – Type: Madagascar, Province

Antsiranana, Sava, Réserve Naturelle de Marojejy, western slopes of Montagne de Beondroka, 23–24 Oct. 1989, Miller & Randrianasolo 4397 (holo-: MO; iso-: K, P, TAN).

Small subshrub up to 25 cm tall; young internodes brown, smooth; older internodes brown to dark brown, somewhat corky; all external parts glabrous, except rarely the inflorescence axes. Leaves: petioles 0.2–1 cm long; blades elliptic or narrowly elliptic, more rarely somewhat obovate or ovate, (5–)6.8–15 × 1.5–5.5 cm, papyraceous to subcoriaceous, drying pale or yellowish green, green or brown, somewhat

paler below; apex acuminate with acumen up to 2 cm long; base cuneate to attenuate or rarely acute; 10–16 pairs of lateral nerves. Stipules caducous, sheath 1.5–3 mm long, awn 1–1.5 mm long. Inflorescences sessile, compact to lax, with (3–)5–18 flowers, not articulate throughout, 0.7–3.5 cm wide and 0.5–3 cm long; modified inflorescence-supporting leaves absent; axes glabrous or more rarely sparsely pubescent with very short hairs; central first order axis 0–1.5 cm long, lateral first order axes 0–2 cm long; first order bracts with stipular parts fused into a blade with a central awn and foliar parts absent or forming small leaves; higher order bracts rarely similar to first order bracts but reduced, but usually with stipular parts absent and foliar parts triangular and vaulted, narrowly triangular, somewhat fimbriate or linear, up to 2 mm long. Ultimate flower triads: flowers (sub)sessile to shortly pedicellate; pedicels 0–3 mm long, pedicels of central flowers (up to 0.5 mm long) shorter than those of lateral flowers (0.5–3 mm long); bracteoles usually absent, if present then opposite at the base of the ovary, narrowly triangular or filiform, up to 1 mm long. Flowers: flower bud with obtuse apex; calyx c. 1 mm long, tube 0.3–0.5 mm long, lobes variable in shape, triangular, ovate or truncate with central acumen, 0.3–0.5 mm long, apices obtuse or acute, smaller interstitial lobes often present; corolla tube 4–12 mm long; corolla lobes 3.5–6 mm long, c. 2 mm wide, apices obtuse; stamens spreading at anthesis, filaments c. 2 mm long, anthers c. 2.5 mm long; ovary bilocular, 0.75–1 mm long; style exerted 2–4 mm, stigmatic lobes 0.75–1.5 mm long. Fruits subglobose, 0.8–1 cm in diameter when bilocular, but ovoid, 0.5–0.6 cm wide, 0.8–1 cm long when unilocular; fruit wall thin; seeds c. 0.7 cm long, c. 0.4 cm wide. Fig. 9.

**Habitat** – Lowland and mid-altitude humid eastern forest, altitude: 150–850 m.

**Distribution** – North-eastern Madagascar: known from Masoala Peninsula and the Sambava-Andapa-Marojejy region (provinces Antsiranana and Toamasina). Fig. 7C.

**Phenology** – Flowers: October – November; fruits: April – July.

**Living colours** – Inflorescence axes green tinged red; ovary and calyx greenish or whitish tinged red; corolla white, white tinged pink or pink; stamens white; fruits red.

**Critical remarks** – *Ixora pedalis* shows a large variation in the inflorescence structure, from compact to lax. Inflorescence axes may be completely reduced and all flowers sessile in certain specimens, whereas others have inflorescence axes up to 2 cm long. – The inflorescence is not articulate throughout, with articulation often absent in the ultimate flower triads. Usually, lateral flowers are articulate, central ones are not. – The subshrub habit together with the few-flowered inflorescences renders *I. pedalis* unique amongst the Madagascan *Ixora* species. The only other species with a subshrub habit have uniflorous inflorescences: *I. bemangidiensis* Guédès and *I. reducta* Drake ex Guédès (De Block 2008).

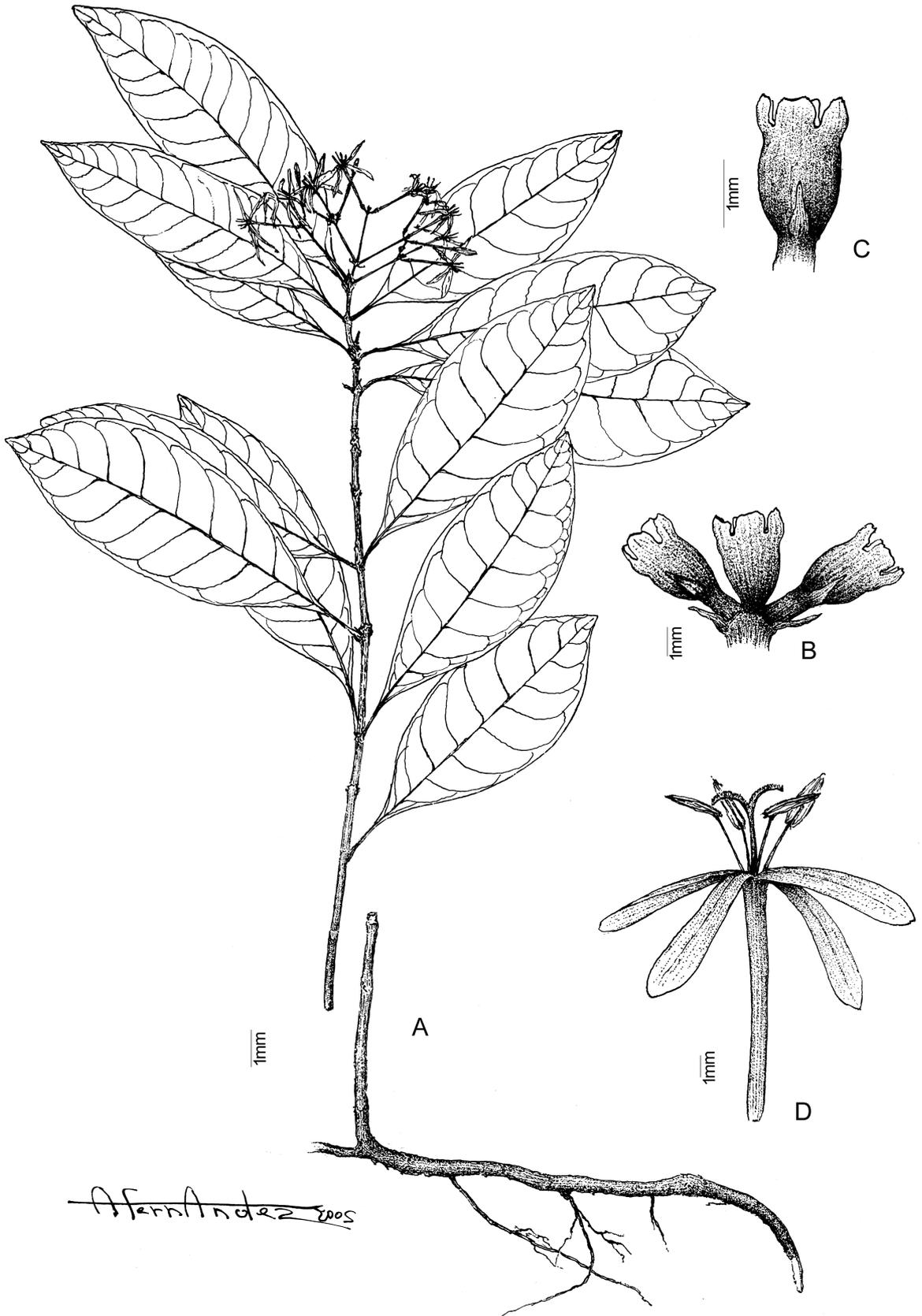
**Other collections examined** – **Madagascar**: *Antsiranana*: Sava, Analamanara, près du village de Tsaratanana, entre Antsirabe-Nord et Sambava, 24 Oct. 1966, *Capuron* 24910-SF (P, TEF); Sava, canton Doany, district Andapa, 29 Apr. 1957, *coll. ignot.* 8853-RN (TEF); Sava, sous-préfecture d'Andapa, commune Doany, fok. Bet-

somanga, versant NW du Marojejy, 0,2 km E du camp 1, au point 003, 16 Oct. 2001, *Gautier, Ravelonarivo & Andriamparany* 3837 (BR, G). – *Toamasina*: Analanjirofo, Maroantsetra, SE of Ambanizana, along ridge SE of Androka River, SE of Maroantsetra, 15 Oct. 1986, *Lowry, Rakotozafy & Nicoll* 4128 (MO, TAN); Analanjirofo, Masoala Peninsula, Ambanizana, south trail, S of Androka River climbing into hills SE of Ambanizana, 1 Nov. 1992, *Schatz, van der Werff, Gray & Razafimandimbison* 3407 (MO); Analanjirofo, Masoala Peninsula, Point Tompolo, Jul. 1993, *Zjhra & Hutcheon* 543 (MO).

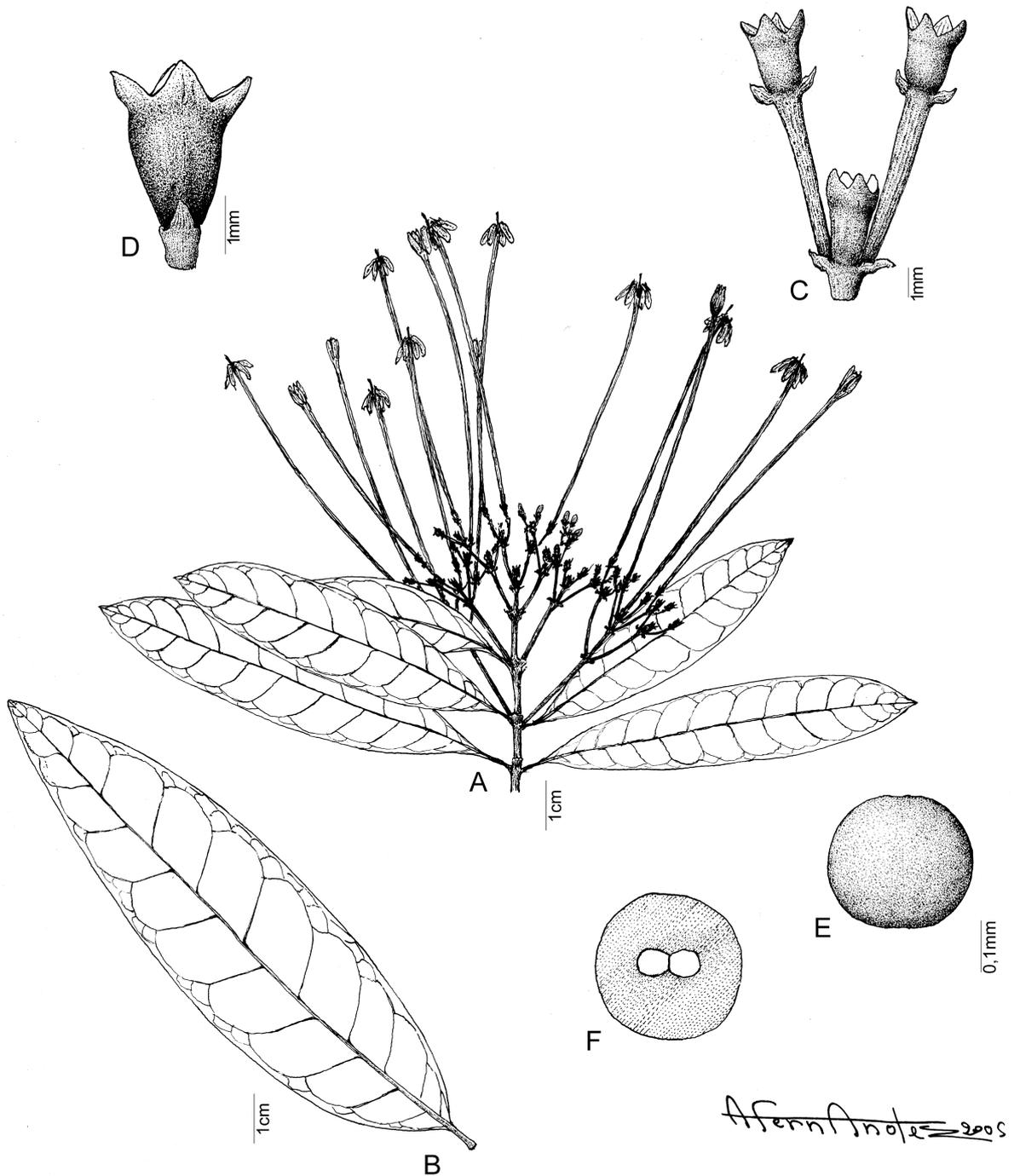
### *Ixora ripicola* De Block, sp. nov.

Corollis longis et fructibus magnis *Ixora guillotii* similis, sed differt fructuum forma subspherica et pericarpio percasso, stipularum brevioribus (vaginae 1.5–3 mm longis versus 3–6 mm; aristae 1–1.5 mm longis versus 0.5–5 mm), bracteolarum brevioribus [ $\leq$  1 mm longis versus 1–2(–3) mm], filorum longioribus (1.5–3 mm longis versus 0.5–0.75 mm) et corollarum lobis brevioribus [0.6–0.8(–0.9) cm longis versus 1–1.6 cm]. – Type: Madagascar, Province Antsiranana, Diana, Réserve Naturelle Intégrale d'Ankarana, 18 May 1987, *Nicoll & Abraham* 675 (holo-: MO; iso-: BR, K, P, S, TAN, WAG).

Tree or rarely shrub, up to 20 m tall, dbh up to 35(–80) cm; internodes often short, especially below the inflorescences; young internodes brown, smooth; older internodes brown, somewhat corky; all external parts glabrous except for inflorescence axes and pedicels in some specimens. Leaves: petioles 0.4–1 cm long; blades narrowly elliptic, narrowly obovate or narrowly ovate, more rarely elliptic, 6–18 × 1.5–4 cm, coriaceous or subcoriaceous, drying brown above, somewhat paler below; apex acute or shortly acuminate, acumen up to 1 cm long; base cuneate, acute or obtuse, often somewhat unequal; 12–20 pairs of lateral nerves. Stipules: sheath 1.5–3 mm long, awn 1–1.5 mm long. Inflorescences sessile or more rarely shortly pedunculate, lax, with (15–)30–100 flowers, articulate throughout, 2.5–9 cm wide and 3.5–8.5 cm long; modified inflorescence-supporting leaves absent; peduncle 0.5–2 cm long; axes and pedicels glabrous or sparsely to moderately pubescent with short erect hairs; central first order axis 0.5–2.2 cm long, lateral first order axes 1.2–3.5 cm long; first (and rarely second) order bracts with stipular parts forming a low sheath with a central awn and foliar parts forming leaves similar in shape and size to vegetative leaves (up to 3 × 8 cm); higher order bracts with stipular parts absent, foliar parts broadly triangular and vaulted, up to 3 mm long. Ultimate flower triads: flowers sessile to pedicellate; pedicels 0–8 mm long, central flowers (sub)sessile (pedicels 0–1 mm long) and lateral flowers pedicellate (pedicels 1–7 mm long) but pedicels of central and lateral flowers 3–8 mm long in case of reduction; bracteoles usually absent on central flowers but present on lateral ones, opposite at the base of the ovary, broadly triangular, up to 1 mm long. Flowers: flower bud with acute to obtuse apex; ovary and calyx often drying dark brown or blackish with calyx lobes or margins of calyx lobes paler brown; calyx 1–1.5 mm long, tube up to 0.5 mm long, lobes triangular or broadly triangular, 0.75–1(–1.5) mm long, apices obtuse to rounded; corolla tube (27–)34–90 mm long; corolla lobes 6–8(–9) mm long, 3–4 mm wide, apices obtuse to rounded;



**Figure 9** – *Ixora pedalis*: A, flowering plant; B, ultimate flower triad (corollas removed); C, bracteole, ovary and calyx; D, corolla, stamens, style and stigma (A–D, from Miller & Randrianasolo 4397). Drawn by Antonio Fernandez.



**Figure 10** – *Ixora ripicola*: A, flowering branch; B, leaf; C, ultimate flower triad (corollas removed); D, bracteole, ovary and calyx; E, fruit; F, transverse section of fruit showing massive fruit wall (A, C & D, from *Andrianantoanina et al.* 805; B, from *Ursch* 244; E & F, from *coll. ignot.* 10665-SF). Drawn by Antonio Fernandez.

stamens spreading at anthesis, filaments 1.5–3 mm long, anthers 5–6 mm long; ovary bilocular, 1.5–2 mm long; style exerted 4–7 mm, stigmatic lobes 1.5–2 mm long. **Fruits** subglobose, 2.5–3 cm in diameter; fruit wall 0.5–1 cm thick (in dry fruits); seeds 1–1.2 cm long, 0.6–0.7 cm wide. Fig. 10.

**Habitat** – Dry semi-deciduous or deciduous western forest, also in sublittoral forest; often on a river bank or bordering

a streambed; reported from very different soil types such as sand, limestone, basalt, laterite and clay, altitude: 50–900 m.

**Distribution** – Western Madagascar; from the region of Morondava to the northernmost tip of the island (provinces Antsiranana, Mahajanga and Toliara). Fig. 7D.

**Phenology** – Flowers: May – July, *Humbert* 11421 from Toliara flowers in October; fruits: July – November.

**Table 4 – Distinguishing characters for *Ixora ripicola*, *I. cremixora* and *I. guilotii*.**

	<i>I. ripicola</i>	<i>I. cremixora</i>	<i>I. guilotii</i>
Habit	Tree or rarely shrub, up to 20 m tall, dbh up to 35(–80) cm	Shrub or small tree, 2–10 m tall	Shrub or rarely small tree, up to 5 m tall
Leaf blades	6–18 × 1.5–4 cm	5–23(–30) × 1.5–6(–8) cm	11–35 × 3–8 cm
Peduncle length	0–2 cm	0 cm	(0.5–)1.5–6.5 cm
Modified inflorescence-supporting leaves	absent	absent	1–3 pairs
Pedicel length	0–8 mm	(3.5–)6–20 mm	0–10 mm
Presence of bracteoles	usually present in lateral flowers	often absent	usually present in lateral flowers
Bracteoles	broadly triangular, up to 1 mm long	filiform or narrowly triangular, up to 1 mm long	narrowly triangular, 1–2(–3) mm long
Calyx lobes	lobes triangular or broadly triangular, 0.75–1(–1.5) mm long	lobes shortly triangular, < 0.3 mm long	lobes triangular or broadly triangular, 0.75–2.5(–3) mm long
Filament length	1.5–3 mm long	1–1.5 mm long	0.5–0.75 mm
Fruit size	2.5–3 × 2.5–3 cm	1–1.2 cm wide, 0.8–1 cm long	1.2–1.5 cm wide, 1.4–1.7 cm long
Fruit wall	thick (0.5–1 cm in dry fruits)	thin	thin

**Living colours** – Inflorescence axes and pedicels green; corolla white or white tinged pink, turning yellow with age; fruits red. Flowers fragrant.

**Vernacular names** – Hazomena; hazompanenitra; menahatra; motrobeantiniana; sohiala; tsintsarotsano, tsontsarakefotsy; vahirota.

**Uses** – Construction wood (poles for fences, huts, etc.).

**Critical remarks** – The name *I. ripicola* was first used in P, but remained unpublished; its author is unknown. – *I. ripicola* possesses large subspherical fruits with a massive fruit wall, similar to the fruits encountered in some Mascarene *Ixora* species such as *I. borboniae* Mouly & B. Bremer in which the number of locules vary between three and seven (Verdcourt 1989, as *Myonima obovata* Lam.). – *I. ripicola* resembles *I. cremixora* Drake and *I. guilotii* Hochr. by the large, lax or relatively lax inflorescences [2.5–12.5(–30) cm wide, 3–12(–20) cm long] and the flowers of similar length [(2.7–)3.4–9 cm long]. *I. ripicola* and *I. cremixora* have the same distribution range and both occur in lowland to mid-altitudinal semi-deciduous or deciduous dry western forest. But the two species differ by habit, pedicel length, presence/absence and size of bracteoles, size and shape of calyx lobes, filament length, fruit size and thickness of fruit wall (table 4). *I. guilotii* occurs in littoral and sublittoral forest, mostly in eastern Madagascar. This species differs from *I. ripicola* by habit, pedunculate inflorescences subtended by modified inflorescence-supporting leaves, shape and size of bracteoles and calyx lobes, filament length, size and shape of fruit and thickness of fruit wall (table 4).

**Other collections examined** – **Madagascar:** *Antsiranana:* Diana, Réserve Spéciale d’Ankarana, env. 108 km SW d’Antsiranana par route, W de Mahamasina, 31 May 1995, *Andrianantoanina, Bezana, Zjhra & Hutcheon* 805 (BR, MO, P, TAN); Diana, Andavakombo, canton Anivorano-Nord, 30 Aug. 1954, *coll. ignot.* 10665-SF

(P, TEF); Diana, exploitation Walzer, Tsarakibany, canton Anivorano-Nord, 17 Jun. 1955, *coll. ignot.* 15054-SF (BR, P, TEF); Diana, jardin botanique 8, Ambondromifely, canton Anivorano-Nord, 23 Nov. 1955, *coll. ignot.* 15190-SF (BR, P, TEF); Diana, Anjanikely, Andriafiabe, 23 Sep. 1980, *coll. ignot.* 29950-SF (TEF); Diana, forêt d’Ankarana, Ratsalahimango, fiv. Ambilobe, 20 May 1987, *coll. ignot.* 31580-SF (TEF); Diana, Réserve Spéciale d’Ankarana, 22–26 Nov. 1992, *Malcomber, Leeuwenberg, Van Bergen, Andriatiana & Randriamamapionona* 1893 (BR, K, MO, P, TAN, WAG); Sava, fiv. Vohemar, commune rurale Nossi-Be, fok. Anjiabe, forêt d’Analabe, 11 May 2004, *Rabehevitra, Razakamalala & Mathie* 962 (BR, MO); Diana, fiv. Diego II, commune Ramena, fok. Andavakoera, forêt d’Andranonakomba, montagne des Français, 8 Sep. 2004, *Randrianaivo, Rakotondrajaona, Razafitsalama, Rakotondrafara, Benjara & Be* 1083 (K, MO); Sava, fiv. Vohemar, commune rurale Nossi-Be, forêt littorale d’Analabe près du village d’Anaborano et du Lac Sahaka, 10 Jul. 2003, *Razakamalala, Rabehevitra & Rakotomamonjy* 520 (BR, K, MO); Sava, fiv. Vohemar, commune rurale Nossi-Be, forêt littorale d’Analabe près du Lac Sahaka, 13 May 2004, *Razakamalala, Rabehevitra & Mathieu* 1244 (BR, MO); Diana, N de Joffreville, s.d., *Ursch* 244 (P). – **Mahajanga:** Boeny, Réserve Naturelle Intégrale 8, Namoroka, Andranomavo, district Soalala, 29 Oct. 1952, *coll. ignot.* 4622-RN (TAN); Sofia, forêt Tsangitangina, Ambarijebly, canton Befandriana, district Befandriana-Nord, 7 Sep. 1956, *coll. ignot.* 16089-SF (BR, P); Sofia, forêt entre les villages de Mevahiaka et Tsarahonenana, village le plus proche Mevahiaka, canton Tsarahonenana, district Refaridiana, 19 Oct. 1960, *coll. ignot.* 19800-SF (BR, P, TEF); Sofia, Analazezy, village Ankobakobaka, canton Befandriana-Nord, 28 Jul. 1970, *coll. ignot.* 30039-SF (P, TEF); Boeny, rive gauche de la Mahavahy, environs de Itampika, Ambongo, Aug. 1904, *Perrier de la Bâthie* 1753 (P); Boeny, plateau d’Antanimena, Jun. 1906, *Perrier de la Bâthie* 3701 (P); Boeny, Ambongo, s.d., *Perrier de la Bâthie* 3820 (P); Vakinankaratra, Belambo, environs Maevatanana, Jul. 1900, *Perrier de la Bâthie* 3869 (BR, P). – **Toliara:** Menabe, forêt de Marofandilia entre Morondava et la Tsiribihina, Oct. 1933, *Humbert* 11421 (P) & 11422 (P). – **Without locality:** s.d., *Homolle* 24 (BR, P).

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