

# TWO NEW RECORDS AND MORPHOLOGICAL DISCUSSIONS OF ARISTOLOCHIA (ARISTOLOCHIACEAE) FROM RIO DE JANEIRO STATE, BRAZIL

Joelcio Freitas

Programa de Pós-Graduação em Botânica  
Universidade Estadual de Feira de Santana  
Av. Transnordestina s.n.  
Feira de Santana, Bahia, 44036-900, BRAZIL  
and

Laboratório de Sistemática e Genética Vegetal  
Departamento de Ciências Agrárias e Biológicas  
Univ. Federal do Espírito Santo - UFES/CEUNES  
Rodovia BR 101 Norte, Km 60, Bairro Litorâneo  
São Mateus, ES, 29932-540, BRAZIL  
joelciofr@gmail.com

Elton John De Lório

Departamento de Botânica  
Instituto de Biociências, Universidade de São Paulo  
Rua do Matão 277, Edifício Sobre-as-ondas (Herbário)  
São Paulo, SP, 05508-900, BRAZIL

Elsie Franklin Guimarães

Programa de Pós-graduação em Botânica  
Escola Nacional de Botânica Tropical  
Inst. de Pesquisas Jardim Botânico do Rio de Janeiro  
Rua Pacheco Leão, 2040, Solar da Imperatriz, Horto  
Rio de Janeiro, RJ, 22460-030, BRAZIL

Anderson Alves-Araújo

Programa de Pós-Graduação em Botânica  
Universidade Estadual de Feira de Santana  
Av. Transnordestina s.n.  
Feira de Santana, Bahia, 44036-900, BRAZIL  
and

Laboratório de Sistemática e Genética Vegetal  
Departamento de Ciências Agrárias e Biológicas  
Univ. Federal do Espírito Santo - UFES/CEUNES  
Rodovia BR 101 Norte, Km 60, Bairro Litorâneo  
São Mateus, ES, 29932-540, BRAZIL

## ABSTRACT

*Aristolochia bahiensis* F. González and *Aristolochia hypoglauca* Kuhl. are reported as new records to the flora of Rio de Janeiro state, Brazil, and additionally we provide a discussion about morphological differences between *Aristolochia tamnifolia* (Klotzsch) Duch. and *A. bahiensis*. We present photographs, a geographic distribution map, and morphological observations for these three species.

KEY WORDS: *Piperales*, *Aristolochia* series *Hexandrae*, Atlantic forest

## RESUMO

*Aristolochia bahiensis* F. González, *Aristolochia hypoglauca* Kuhl. são reportadas como novas ocorrências para o estado do Rio de Janeiro, Brasil e são discutidas diferenças morfológicas de *Aristolochia tamnifolia* (Klotzsch) Duch. e *A. bahiensis*. São fornecidas fotografias, distribuição geográfica e comentários morfológicos para as três espécies.

PALAVRAS CHAVE: *Piperales*, *Aristolochia* série *Hexandrae*, Mata Atlântica

## INTRODUCTION

*Aristolochia* L. (Aristolochiaceae: Aristolochioideae) has tropical and temperate distribution and approximately 550 species (González 1990, 2012; Wanke et al. 2006). Although studies have shown the toxicity of aristolochic acids, often found in the genus, a remarkable number of species of the genus is used worldwide in traditional medicine (WHO 2004; Nitzsche et al. 2013). In addition, the genus has important ecological interactions with several groups of invertebrates. For example, there are antagonistic relationships with caterpillars of the tribe Troidini (Lepidoptera: Papilionidae) that feed almost exclusively on leaves of *Aristolochia* and mutualistic interactions between pollinators (Diptera) and flowers and between seeds and dispersers (Formicidae) (Freitas et al., in prep.). Brazil has the highest diversity of species of *Aristolochia* with 93 taxa; 38 of them are endemic. The Amazonia, Cerrado, and Atlantic forests are the most diverse biomes globally (BFG

2015, 2018). In Rio de Janeiro state (RJ), which is in the Atlantic forest, an earlier checklist of Aristolochiaceae includes 22 species (Pereira et al. 2014). A new endemic species was recently described, *Aristolochia insolita* J. Freitas & M. Peixoto, from RJ (Freitas et al. 2017). In addition, we discovered two new state records and observed some morphological variation of *Aristolochia* species from RJ. Here, we report *Aristolochia bahiensis* F. González (Fig. 1A–B) and *Aristolochia hypoglauca* Kuhlmann (Fig. 1C–D) as new state records, provide illustrations and geographic distribution maps, and discuss the range of variation of morphological features between *Aristolochia taminifolia* (Klotzsch) Duch. (Fig. 1E–G) and *A. bahiensis* (included for species' circumscriptions).

#### MATERIALS AND METHODS

This study is based on new information gathered from observation of greenhouse-grown plants at the Instituto Nacional da Mata Atlântica (Santa Teresa, state of Espírito Santo) collected in the state of Rio de Janeiro and specimens from the following herbaria: ALCB, CEPEC, CVRD, HSTM, HUEFS, IAN, INPA, MBML, MG, R, RB, and VIES (Thiers, continuously updated). Descriptions using general morphological characters of the species follow Harris and Harris (2001), except for those characters specific to *Aristolochia* flowers and fruits, which were described by González (1990).

#### RESULTS AND DISCUSSION

##### New records to Rio de Janeiro state

***Aristolochia bahiensis*** F. González, *Brittonia* 50:8. 1998. TYPE: BRAZIL. BAHIA: Una, Biological Reserve of Mico-leão (IBAMA), entrance of km 46 of road BA-001 Ilhéus to Una, branch to Jaqueiral farm, ca. 8 km of the entrance [“Reserva Biológica do Mico-leão (IBAMA), entrada no km 46 da Rodovia BA-001 Ilhéus - Una, ramal que leva à Fazenda Jaqueiral, ca. 8 km da entrada”], 15°09'S, 39°05'W, 1 May 1996, fl., J. Jardim et al. 809 (HOLOTYPE: CEPEC!; ISOTYPE: NY).

*Aristolochia bahiensis* belongs to *Aristolochia* series *Hexandrae* (Duch.) F. González subseries *Anthocaulicae* F. González and is characterized by cauliflorous racemes with short internodes (<1 mm long) (González 1990, 1998). The species is morphologically similar to *A. subglobosa* J. Freitas, Lirio, & F. González, but differs by slightly peltate leaves and cylindrical fruits (vs. leaves not peltate and fruits subglobose in *A. subglobosa*) (Freitas et al. 2013). *Aristolochia bahiensis* is restricted to the Brazilian Atlantic forest, occurring in montane and lowland rainforests from Alagoas, Bahia, and Espírito Santo states (BFG 2015, 2018). Herein, its geographic distribution is expanded to the municipality of São Fidélis, RJ, approximately 200 km farther south (Fig. 2). The specimen from RJ (*I.G. Costa* 128 - RB690441) has cordate leaves at the base and flowers with a limb that is white with purple spots inside (Fig. 1A–B). This coloration pattern differs from specimens located at the type locality and in the central region of Espírito Santo state (slightly cordate leaves to sometimes truncate and the flower limb with yellow inside). This morphological variation was also reported for the specimens from northern Espírito Santo (Freitas & Alves-Araújo 2017). Complete description is available in Freitas and Alves-Araújo (2017). At the municipality of São Fidélis, *Aristolochia odora* Steud., *Aristolochia nevesarmondiana* Hoehne, and *Aristolochia taminifolia* are sympatric with *A. bahiensis*.

Voucher specimen for *A. bahiensis*: BRAZIL. Rio de Janeiro: São Fidélis: localidade de Tapera, 26 Mar 2011, *I.G. Costa* 128 (RB 01297748).

***Aristolochia hypoglauca*** Kuhlmann, *Arq. Inst. Biol. Veg.* 3:45. 1936. TYPE: BRAZIL. UNKNOWN MUNICIPALITY: Três Ilhas location, Rio Doce margin, without date, fl., J.G. Kuhlmann 238 (HOLOTYPE: RB!).

*Aristolochia hypoglauca* (Fig. 1C–D) belongs to *Aristolochia* series *Hexandrae* subseries *Hexandrae* (Duch.) F. González and is characterized by single flowers without bracts (González 1990; Freitas & Alves-Araújo 2017). This species is morphologically similar to *A. trilobata* L. and *A. paulistana* Hoehne, both unilabiate with a long limb (15–35 mm long) and found in the Atlantic forest. *Aristolochia hypoglauca* differs from both species by the oval shaped leaf blades (vs. trilobed in *A. trilobata* and deltoid in *A. paulistana*). It differs also from *A. paulistana*, the closest related species, by the leaf margin not being constricted at the median zone (vs. leaf margin constricted at the median zone in *A. paulistana*), the size of the limb and utricle (approximately half the length of

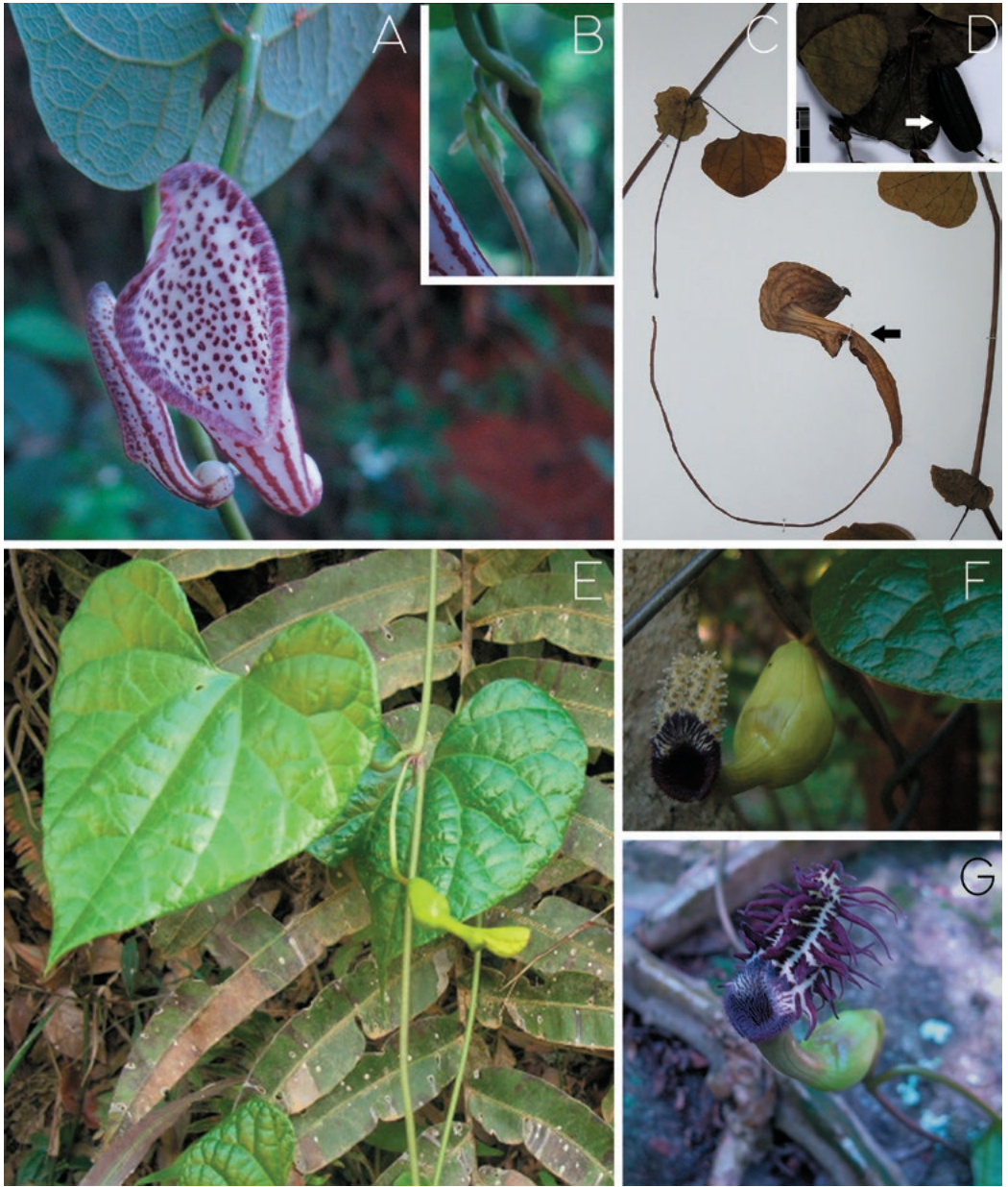


FIG. 1. A–B. *Aristolochia bahiensis* F. González. A. Flower. B. Raceme detail. C–D. *Aristolochia hypoglauca* Kuhl. C. Branch with flower (MBML47350). D. Branch with fruit indicated by a white arrow (RB746482). E–G. *Aristolochia tannifolia* (Klotzsch) Duch. E. Branch with young flower. F–G. Variation in floral limb fimbriae. F. Flower with white and short fimbriae (MBML53138). G. Flower with vinaceous and long fimbriae (MBML47677). Photos: Idimá Gonçalves Costa (A, B, G); Joelcio Freitas (C, D, F); André Paviotti Fontana (E).

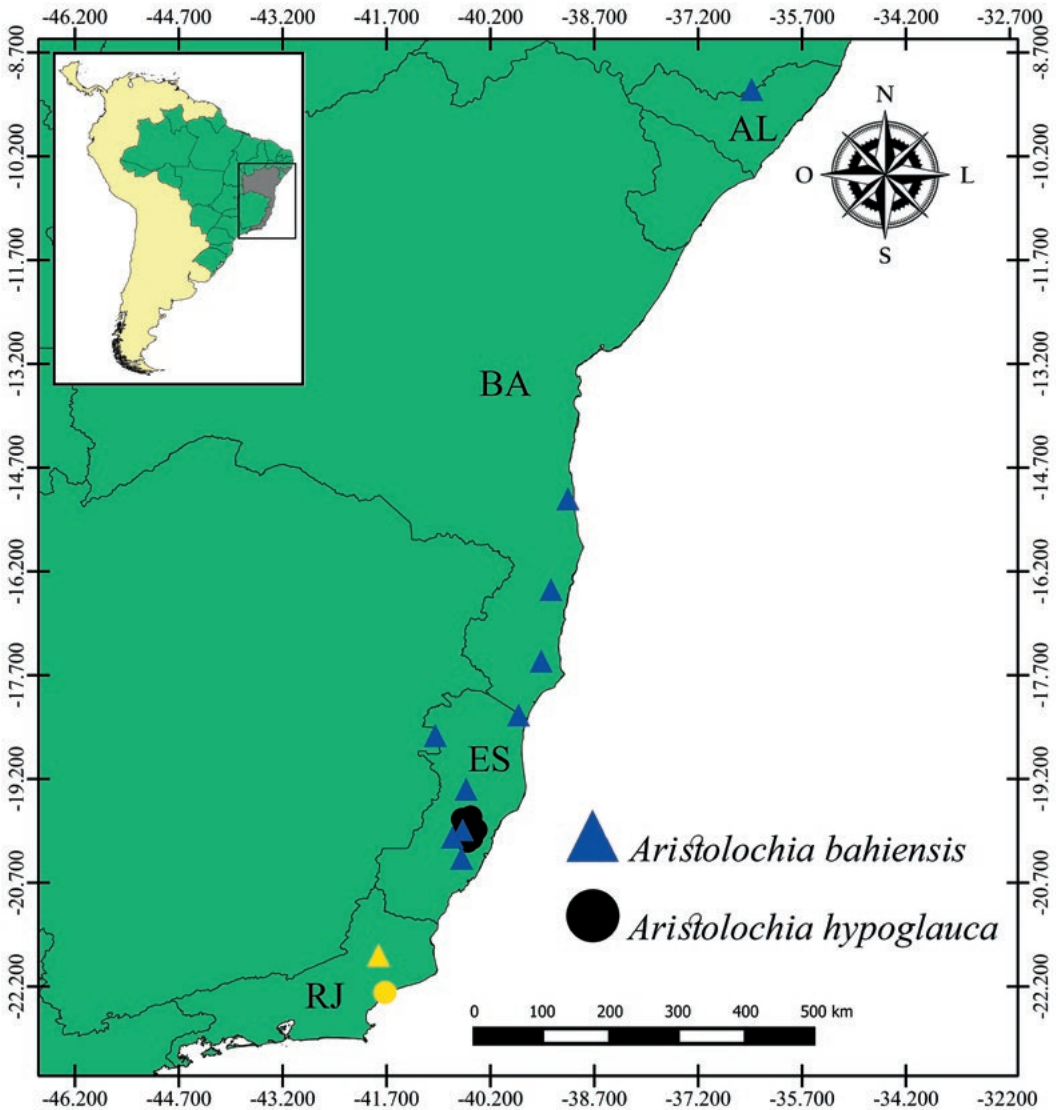


FIG. 2. Geographical distribution of *Aristolochia bahiensis* (triangle) and *A. hypoglauca* (circle). Yellow symbols indicate new occurrences.

*A. paulistana*), and in distribution: *A. paulistana* occurs in Paraná and São Paulo and *A. hypoglauca* is currently known only for Espírito Santo (BFG 2015, 2018; Capellari Jr. 2002; Freitas & Alves-Araújo 2017).

*Aristolochia hypoglauca* occurs in montane and submontane rainforests on forest or road edges or in humid environments near rivers and springs. Here, its distribution is expanded to RJ in the municipality of Macaé, Northeastern RJ, approximately 200 km farther south (Fig. 2). The species is listed in the Red Book of the Brazilian Flora (Menini Neto et al. 2013) and in the Official Threatened Flora Species List (MMA 2014) as Endangered (EN). In the municipality of Macaé, *Aristolochia odora*, *Aristolochia tamnifolia*, and *Aristolochia trilobata* L. are sympatric with *A. hypoglauca*.

Voucher specimen for *A. hypoglauca*: **BRAZIL. Rio de Janeiro. Macaé**: Frade de Macaé, 26 Sep 2013, L. Kollmann 12829 (MBML 47350); Córrego do Ouro, Estrada RJ-162, Km 45. 28 Jun 2016, J.M. A Braga 16-008 (RB 746482).

### Morphological discussion

***Aristolochia tamnifolia*** (Klotzsch) Duch., Prodr. 15(1):448. 1864. TYPE: BRAZIL: "Hab. in Brasilia," *Sellow 146* (HOLOTYPE: B, lost; LECTOTYPE: BR; ISOLECTOTYPES: K, P).

*Aristolochia tamnifolia* (Fig. 1E–G) also belongs to *Aristolochia* subseries *Hexandrae* (González 1990; Freitas & Alves-Araújo 2017) and is morphologically similar to *Aristolochia zebrina* J. Freitas & F. González. *Aristolochia tamnifolia* differs from *A. zebrina* by the limb being broadly ovate to oblong, 1.2–1.9 cm long, fimbriate at the apex (vs. limb narrowly ovate, 2.7–4 cm long, and fimbriae absent in *Aristolochia zebrina*). The species occurs in Atlantic rainforest and Cerrado in the states of Alagoas, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, and Sergipe (BFG 2015, 2018).

The specimens collected North (municipality of Cardoso Moreira and São Fidélis) and Northeast (municipality of Macaé) of RJ show curious morphological variation of the fimbriate limb when compared to specimens from other areas. In the specimen from Macaé (Fig. 1F), the floral limb is white and short with verrucose fimbriae ca. 3 mm long while specimens from Cardoso Moreira (Fig. 1G) have vinaceous fimbriae up to 13 mm long.

Voucher specimen for *A. tamnifolia*: **BRAZIL. Rio de Janeiro. Cardoso Moreira**: Fazenda Santa Rita, Serra da Bandeira, 26 Mar 2011, I.G. Costa 127 (MBML 47677). **Macaé**: Tapera, estrada para Trajano de Moraes, beira da cachoeirinha, 27 Aug 2013, A.P. Fontana 7727 (MBML 53138). **São Fidélis**: localidade de Tapera, 31 Aug 2013, I.G. Costa 246 (MBML 53122).

### ACKNOWLEDGMENTS

We acknowledge the help of herbaria staff and curators of MBML and RB. We also thank Idimá Gonçalves for sending us his collections of *Aristolochia* from RJ and for allowing us to use his photographs. We thank the two anonymous reviewers and the editor for their comments on this paper. The first and second authors thank Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the PhD (grant #141415/2016-9) and postdoctoral (grant #153129/2018-2) fellowships, respectively.

### REFERENCES

- BFG - THE BRAZIL FLORA GROUP. 2015. Growing knowledge: An overview of seed plant diversity in Brazil. *Rodriguésia* 66(4):1085–1113.
- BFG - THE BRAZIL FLORA GROUP. 2018. Brazilian flora 2020: innovation and collaboration to meet Target 1 of the Global Strategy for Plant Conservation (GSPC). *Rodriguésia* 69:1513–1527
- CAPELLARI, JR., L. 2002. Aristolochiaceae. In: M.G.L. Wanderley, G.J. Shepherd, & A.M. Giulietti, eds. *Flora Fanerogâmica do Estado de São Paulo, Brazil*. 2:39–49.
- FREITAS, J., E.J. LÍRIO, & F. GONZÁLEZ. 2013. A new cauliflorous species of *Aristolochia* (Aristolochiaceae) from Espírito Santo, Brazil. *Phytotaxa* 124(1):51–59.
- FREITAS, J., E.J. LÍRIO, M. PEIXOTO, E.F. GUIMARÃES, & A. ALVES-ARAÚJO. 2017. *Aristolochia insolita* (Aristolochiaceae), a new species from Rio de Janeiro, Brazil. *Syst. Bot.* 42(1):169–174.
- FREITAS, J. & A. ALVES-ARAÚJO. 2017. Flora do Espírito Santo: Aristolochiaceae. *Rodriguésia* 68(5):1505–1539.
- GONZÁLEZ, F. 1990. Flora de Colombia. Aristolochiaceae. Monografía No. 12. Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Colombia.
- GONZÁLEZ, F. 1998. Two new species of *Aristolochia* (Aristolochiaceae) from Brazil and Peru. *Brittonia* 50:5–10.
- GONZÁLEZ, F. 2012. Florística y sistemática filogenética innecesariamente disyuntas: El caso de *Aristolochia*, *Euglypha* y *Holostylis*. *Revista Acad. Colomb. Ci. Exact.* 36:193–202.
- HARRIS, J.G. & M.W. HARRIS. 2001. *Plant identification terminology: An illustrated glossary*. 2nd ed. Spring Lake Publishing, Payson, Utah, U.S.A.
- PEREIRA, D., E.J. LÍRIO, & J. FREITAS. 2014. Aristolochiaceae. Catálogo das espécies de plantas vasculares e briófitas do Estado do Rio de Janeiro. Rio de Janeiro: Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Brazil. Available at : <http://florarijaneiro.jbrj.gov.br>, accessed 26 Jul 2018.

- MENINI-NETO, L., S.G. FURTADO, D. MAURENZA, J.S. REIS JÚNIOR, & M.B. ABREU. 2013. *Aristolochiaceae*. In: Martinelli, G. & M.A. Moraes. Livro Vermelho da Flora do Brasil. Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Brazil. Pp. 196–197.
- MMA (MINISTÉRIO DO MEIO AMBIENTE). 2014. Lista Nacional Oficial de Espécies da Flora Ameaçadas de Extinção. Portaria MMA no. 443, Brasília, Brazil.
- NITZSCHE, D., M.F. MELZIG, & V.M. ARLT. 2013. Evaluation of the cytotoxicity and genotoxicity of aristolochic acid I - A component of Aristolochiaceae plant extracts used in homeopathy. *Environm. Toxicol. Pharmacol.* 35:325–334.
- THIERS, B. [continuously updated]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium, Bronx, New York, U.S.A. <http://sweetgum.nybg.org/science/ih/>.
- WANKE, S., F. GONZÁLEZ, & C. NEINHUIS. 2006. Systematics of pipevines: Combining morphological and fast-evolving molecular characters to investigate the relationships within subfamily Aristolochioideae (Aristolochiaceae). *Int. J. Pl. Sci.* 167:1215–1227.
- WHO (WORLD HEALTH ORGANIZATION). 2004. Aristolochic acid. *Pharm. Newslett.* 5:1.