Xylocarpus (Meliaceae): A less-known mangrove taxon of the Godavari estuary, India

Extensive field observations during 2000–02 in the mangrove forests of Godavari estuary of Andhra Pradesh (16°30′–17°N and 82°10′–82°23′E) revealed the occurrence of mangrove plants, Xylocarpus mekongensis Pierre, and X. granatum Koen. Their simultaneous occurrence was not recorded earlier. Here we report the history and characteristic features of Xylocarpus species. The earliest record of this taxon from India was made by Hooker in 1882, who reported the occurrence of Carapa mulcensis Lamk (X. granatum Koen.) in India and Sri Lanka1. The occurrence of X. obovatus A. Juss. (X. granatum W&A) in the swamp forests of east coast in Madras Presidency was reported in 1957 by Gamble1. The confusing synonymy between the genera Xylocarpus and Carapa was later resolved and three distinct species of Xylocarpus, i.e. X. granatum Koen., X. mekongensis Pierre, and X. mukcensis (Lamk) Roem. are stated to be distributed in the tropical tidal forests of old world, typically in the mangrove habitat or in sandy or coastal habitat spreading from Africa to Australia through India, Malay Archipelago3. In India all the three species were recorded from Andaman Islands4 and Orissa coast5, while X. granatum and X. mekongensis were reported to occur in Sunderbans6 and Tamil Nadu coast7. Taxonomic surveys8–10 conducted earlier in the mangrove forests of Godavari estuary revealed the rare occurrence of only one species. Thus, information regarding the diversity and distributional details of these important mangrove taxa in Godavari region are incomplete.

Continuous phase-wise observations on Xylocarpus species during two years (2000–02) in Pandi, Pora, Kothapalem, Masanippara and Raticulava areas of the mangrove forests revealed new distributional record. X. mekongensis is more frequent whereas X. granatum is rare. X. granatum and X. mekongensis are moderate-sized trees with well-developed woody trunk yielding valuable timber. They are usually found on the fringes of backwater creeks associated with Avicennia, Excoecaria, Acanthus, Rhizophora, Bruguiera. It is difficult to distinguish these two species based on herbarium specimens without observing the plant in situ. They can be easily recognized from each other in the field based on the characters of root, trunk, bark, leaves, inflorescence and fruit.

Bark and root are quite characteristic in these taxa. In X. mekongensis, the trunk surface is rough, dark brown, fissured with the bark peeling in long thick narrow strips (Figure 1 a). In X. granatum trunk surface is pale, smooth with its thin bark peeling in flakes or patches (Figure 1 b). In X. mekongensis horizontal cable roots produce vertical, conical, laterally compressed knee roots or pneumatophores which may grow up to 30 cm tall (Figure 1 c). In X. granatum, erect, conical knee roots are absent but the horizontal cable roots develop into ribbon-like plank roots. It is observed that both the species possess buttress roots. Leaves are pinnate in both the species. In X. mekongensis the leaves have 1, 2 or 3 pairs of leaflets (Figure 1 d). The leaflets are ovate or oblong with a pointed or blunt tip. The surface of the lamina is flat. Occasionally, unipinnately compound leaves are also observed in this species.

ACKNOWLEDGEMENTS. Financial support from the Ministry of Health and Family Welfare, ISM and Homeopathy, GOI, New Delhi is gratefully acknowledged. We thank the Head, Department of Botany, J.N. Vyas University, Jodhpur for providing facilities. We also thank Prof. David N. Sen and Dr D. D. Chawan for critical discussion and useful comments.

Received 30 September 2002; revised accepted 24 January 2003

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due to reduction of one leaflet in the terminal pair. In *X. granatum* the leaves have 1 or 2 pairs of leaflets. The leaflets are characteristically obovate with a rounded apex. The lamina is gradually tapering towards the thick, distinct petiole. The lamina is coriaceous with a shining surface. In the mature leaves the surface is uneven or undulating (Figure 1 e). Flowering is seasonal in *X. mekongensis*. It usually flowers during late summer or early monsoon, i.e. June–July. It is characteristically deciduous before flowering. After all the leaves are shed new foliage along with flowering is initiated simultaneously and such changes are rapid. The flowering period is short for an individual plant and it lasts for 3–4 weeks. The inflorescence in *X. mekongensis* is lax, up to 10 cm long or more with a distinct main axis. The flowers are creamy white with an attractive orange red disc (Figure 1 d). In contrast, *X. granatum* is evergreen. Regarding the flowering in *X. granatum* there was some doubt, whether it is seasonal or throughout the year. Both chances were considered in detail and it was logically concluded that flowering may be seasonal in this taxon. Flowering throughout the year was recorded from Orissa coast. In the present survey, it is observed that flowering is seasonal in this species. Flowering is seen during the rainy season, i.e. August–September. In *X. granatum* the inflorescence is regular with 3-flowered cymes (usually 6–10) arranged on a zig-zag peduncle and the flowers are strongly pleasant scented (Figure 1 e). The opening of flowers in the inflorescence is not simultaneous. The terminal flower of each cyme opens first and the remaining flowers open later. In the herbarium specimens collected in the later stage of flowering, the inflorescence appears to be irregular due to dropping of several opened flowers along with their pedicels. There are different opinions regarding the size of the flowers in these taxa. It is clear from the present study that the flowers of *X. granatum* are larger, the pedicels are long and stout and gynoeicum is larger than those of *X. mekongensis* (Figure 1 f). The orange
disc around the ovary base is conspicuous with eight prominent lobes. Development of flower and fruit is comparatively slow in this taxon. The fruit in X. mekongensis is subglobose up to 10 cm across, with 10–15 pyramidal seeds, while in X. granatum the fruit is large, globose up to 20–30 cm across. Fruits and seeds and bonyaut in both the taxa.

Mangroves are a valuable component of estuarine biodiversity. This natural ecosystem is exploited by both internal and external agents. The internal forces like the utilization of the mangroves by fisherman for timber, fuel, fodder and medicine is in practice since a long time even from prior to systematic identification of these taxa. External forces like large scale prawn culture practices are devastating these forests and the mangrove stretch is getting depleted day by day. Overexploitation is resulting in the disturbed distribution of some taxa, which are currently under pressure and these may end up in erosion unless conserved. One such taxon is Xylocarpus, which is exploited for its valuable timber. These taxa which were found in the Orissa coast earlier, disappeared in some regions according to a recent report due to excessive felling. Presently a tree of these taxa with developed trunk is rarely found owing to felling. Sufficient number of plants of X. mekongensis is now found in this area, but X. granatum is very rare. During the entire survey I found about 10 plants of this taxon. Thus, there is an urgent need to conserve these precious mangrove tree taxa.


ACKNOWLEDGEMENTS. I thank University Grants Commission for financial assistance and authorities, S.K.B.R. College, Amalapuram for help and encouragement.

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Genetic diversity of Colletotrichum graminicola isolates from India revealed by restriction analysis of PCR-amplified intergenic spacer region of nuclear rDNA

Sorghum anthracnose, caused by *Colletotrichum graminicola* (Ces.) Wilson, is a destructive disease responsible for as high as 50% loss in grain yield. Management of this disease through host plant resistance has often been unsuccessful due to the hyper-variable nature of this fungus. A rapid and reproducible tool for characterizing the pathogen genotypes would help researchers follow the shift in genetic make-up of the pathogen population, thus providing a dynamic picture of the interactions between the host and pathogen genotypes. This would, in turn, help devising strategies for management of this disease. Genetic variability in this fungus was earlier studied by using molecular tools like RFLP and RAPD. RFLP is a reliable tool, but is cumbersome, time-consuming and requires large amount of DNA. RAPD, on the other hand, is simple and rapid, but often not reproducible and error-prone. Restriction analysis of the intergenic spacer region of the rDNA repeats has been useful for variability studies in some fungi like *Fusarium oxysporum* and *Pyrenophora graminea*. Once optimized (primer sequences and enzyme combinations), this technique combines the advantage of both PCR (simplicity and speed) and RFLP (reproducibility). The present communication reports on the successful use of the primer pair originally designed for *F. oxysporum* and identification of a single restriction enzyme, *KpnI*, which can be used for fingerprinting of *C. graminicola* populations.

The *C. graminicola* isolates were collected from six provinces of India where sorghum is cultivated widely (Table I). Monoclonal isolates were grown in potato dextrose medium and DNA isolated, as described earlier. For amplification of the intergenic spacer (IGS) region, primer pair CLN12 (5'TCTGAAA-CGCTTCTAAGTCAG5') and CNS1 (5'TGACACAGCATATGACTACTG5'), designed by Appel and Gordon for *F. oxysporum* was used. Amplification conditions and other techniques were the same as described earlier. Based on variation in the size of the IGS region, the isolates