A CONTRIBUTION TOWARDS AN ECO—TAXONOMIC STUDY OF EUPHORBIACEAE OF KARACHI DISTRICT

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(Received June 15, 1965)

An eco-taxonomic study of the Euphorbiaceae of Karachi district has been carried out in which 26 species and 11 genera have been recorded. Out of these only 14 species distributed over 5 genera are indigenous while the rest are cultivated or naturalized. The genus euphorbia occupies a dominant position comprising over 40% of the total population of Euphorbiaceae and is represented by 8 indigenous species namely: *E. hirta* L., *E. indica* Lamk., *E. caducifolia* Hains., *E. clarkeana* Hook., *E. thymifolia* Burm., *E. prostrata* Ait., *E. granulata* Forsk and *E. dracunculoides* Lamk. and 4 cultivated species namely: *E. tirucalli* L., *E. bojeri* Hook. f., *E. pulcherrima* Willd and *E. geniculata* Orteg. The next dominent genus is phyllanthus which includes 3 indigenous species: *P. niruri* L. sub sp. *fraternus* (Webster) Jafri, *P. scabrifolius* Hook., *P. caroliniensis* and 1 cultivated one *P. distichus* Muell. The rest of genera, *andrachne*, *fluggea*, *chrozophora*, *codiaeum*, *ricinus*, *jatropha*, *manihot* and *putranjiva*, with the exception of *acalypha* which has two species (*A. hispida* Burm. and *A. wilkesiana* Muell.), are represented by a single species each (*Andrachne aspera* Spreng, *Fluggea leucopyrus* Willd., *Chorzophora oblongifolia* (Del) Juss., *Codiaeum variegatum* Blume, *Ricinus communis* L., *Jatropha pandurifolia* Andr., *Manihot utilissima* Pohl. and *Putranjiva roxburghi* Wall). The genera *Andrachne*, *Fluggea* and *Chrozophora* besides *Euphorbia* and *Phyllanthus* and their respective species are wild while the remaining ones are cultivated. To facilitate the identification a key to the tribe, genera and species has been worked out. A new record of *Phyllanthus caroliniensis* Walt has been made for the first time from the Old World whose identifying characters have been described. An analysis of genera and species with a note on their distribution and ecological conditions has been brought out and attempted.

Introduction

The family Euphorbiaceae occupies a prominent position in the flora of Karachi district due to the occurrence of abundant, tall cactus-like, fleshy bushes of *Euphorbia caducifolia* Haines. (Fig. 1). This species readily attracts the attention of visitor and gives a peculiar look to the local vegetation. The herbaceous species such as *E. granulata* Forsk., *E. thymifolia* Burm., *E. prostrata* Ait., *E. clarkeana* Hook. f and *Andrachne aspera* Spreng etc. are also abundantly found throughout the dry sandy expanse which covers the major portion of Karachi. The area under the present study provides a good opportunity for ecological and systematic studies because of the presence of several kinds of habitat such as tidal swamps, sandy sea shore, saline and sandy land, dry sandy flats, low arid rocky and stony hillocks and cultivated areas. Thus keeping in view the local importance of the family the present work was undertaken. Consideration has been given to the distribution and eco-taxonomic position of various taxa of this family.

Fig. 1.—Photograph showing Euphorbia caducifolia Haines,

Physical Aspects

The area under investigation covers about 400 sq. miles. It includes a few scattered small hills towards north upto Orangi Hills and some barren lime stone hillocks of Ghizri (96 ft.) in south. Landhi, the dry, arid more or less gravelly region marks the eastern most limit. The extreme west is bound by alluvial and sandy bed of Hub river. This area thus lies at the west end of the Indus delta on 24.51°N latitude and 67.40°E longitude. Karachi includes three rivers namely: (1) Lyari with two of its small tributories Orangi Nala and Gujro Nala, (2) Malir river with one small Thadoo river and (3) Hub river. Of these the first two remain dry practically throughout the year except during the rainy season when they are drained by side water channels and Nalas. The third one Hub, contains some water throughout the year. Certain important hills with in the area such as Hand's Hill (223 ft.), 6 miles south east of Karachi proper, Matrani Hills (248 ft.), 7 miles east and Orangi Hill (582 ft.), 10 miles north of the centre of the town, serves as a landmark and as an important physical barrier.

Climate.—The climate of Karachi remains moderate throughout the year, due to the effect of Arabian Sea although it is bordered by considerably arid regions like Thar desert on one side and Baluchistan and Mekran on the other. At times Karachi is influenced by cold and heat waves. Winter months, with a mean temperature of 61.35°F., and an occasional minimum of 38.4°F., are drier than summer with an average temperature of 96°F. and maximum 110.4°F. (118°F. during heat wave). Humidity in the inland part is definitely less than at Manora island. Average relative humidity is 62.8% and barometer pressure 29.84 inches Hg. The most humid month is August when the humidity reaches a maximum of 85%. The most dry month is December with the minimum humidity of 38%. The rainy season starts from middle of June and extends upto September with a mean annual rainfall of 7.70 inches. A little rain also falls in winter. About 80% of rainfall occurs from June to August, while only 4% from January to February. The wind direction varies according to the cold, dry and monsoon season. In saline area like Bihar Colony, Mauripur and a part of Clifton sometimes salts are seen deposited on the walls and ground due to high evoporation rate, the annual evaporation being 50.25 inches.

Soil.—The soil of Karachi district is chiefly sandy alluvium and to some extent saline with a high percentage of sand. It ranges from sand and sandy loam of Karachi and Malir to the alluvial clay of the beds of Lyari, Malir and Hub river. The hillocks of Drigh Road and Manghopir are generally gravelly while the plains of Nazimabad, New Karachi and Federal area are predominently clay mixed with sand. The hillocks of Ghizri are quite different from other places being lime stone. In Clifton there are mostly sandy areas with small sand dunes except few hillocks which are lime stone. The highest level within the area does not exceed 100 ft. rising from an initial height of about 5 ft. at Keamari harbour with the exception of certain Hills of which three important ones have been mentioned previously.

Taxonomic Considerations

Key to the Tribe

1. Inflorescence a cyathium. Plants mostly with milky juice..... EUPHORBIEAE

1. Inflorescence not a Cyathium. Plants mostly without milky juice.

   2. 2 ovules in each cell of ovary ....PHYLLANTHEAE

   2. 1 ovule in each cell of ovary..... ....CROTONEAE

Key to Genera

1. Inflorescence a Cyathium.....EUPHORBIA

1. Inflorescence not a Cyathium

   2. Leaves distichous, usually small (apparently young branches looking like a compound leaf.)

      3. Flowers monoceious, pistillode absent (or minute) .....PHYLLANTHUS

      3. Flowers dioecious, pistillode large 2-3 fid .....FLUGGEA

   2. Leaves not distichousiusually comparatively bigger.

      4.2 ovules in each cell .....ANDRACHNE
      4.1 ovule in each cell .....CHROZOPHORA

Cultivated genera

1. Perianth mostly double

   2. Inflorescence paniculate .....JATROPHA
   2. Inflorescence racemose or spicate.....CODIAEUM

1. Perianth mostly single

   3. Leaves palmate

      4. Capsules sub-globose or globose, without wings. .....RICINUS

      4. Capsules ellipsoid with six narrow wings .....MANIHOT

   3. Leaves not palmate

      5. Trees, fruits a globose drupe.....PUTRANJIVA
      5. Herb or shrub, fruit a capsule.....ACALYPHA

Key to Euphorbia

1. Armed shrub with stipulary spines. (cyathium without peltoid bracts).....*E. caducifolia*

1. Unarmed shrub or herb without stipulary spines.

   2. Sub-erect annual weed. Leaves 1.5- 5.2 cm. long

      3. Glabrous weed.

         4. Involucral glands with a prominent membranous peltoid limb. .....*E. indica*

         4. Involucres turbinate, glands semilunate ..... *E. dracunculoides*

      3. Pubescent weed.

         Involucral glands with narrow or without limb. .....*E. hirta*

2. Prostrate wild annual. Leaves 8 mm-1.3 cm. long.

5. Plants glabrous (seeds obscurely transverse, rugose) ....*E. clarkeana*

5. Plants pubescent

6. Cocci angled at the back (Seeds with 4-6 shallow or deep transverse wrinkles)

7. Leaves with indistinct nerves. Cocci pubescent all over....*E. thymifolia*

7. Leaves with 3 prominent nerves. Cocci puberulous only at the angles .....*E. prostrata*

6. Cocci round at the back (seeds faintly pitted) .....*E. granulata*

Cultivated species of EUPHORBIA

1. Armed shrub with stipulary spines. A low sprawling shrub with sub-angular branches, Cyathia supported by two petaloid crimson, orbicular apiculate bracts (grouped dichotomously on a glaborous peduncle). .....*E. bojeri*

1. Unarmed shrub or herb without spines.

2. Flowers without long bracts. Leaves caducuous. Erect shrub or under tree with cylindrical stem, False dichotomy. Flowers in forking or at the tip of branches. .....*E. tirucalli*

2. Flowers supported by bracts. Leaves persistent.

3. Upper floral leaves bright red.....*E. pulcherrima*

3. Upper floral leaves whitish towards the base, green towards the apex.....*E. geniculata*

Key to Phyllanthus

1. Leaves membranous, glabrous, entire.

2. Leaves obovate (stipule, triangular acute). Seeds minutely papillose ....*P. caroliniensis*

2. Leaves oblong (stipules lanceolate, subulate. Seed with 5-6 line along the back.) .....*P. niruri. sub sp. fraternus*

1. Leaves scabrulous, hispidy hairy with wavy margin. .....*P. scabrifolius*

Cultivated species of PHYLLANTHUS

Tree leaves distichous, about 3-6.5 cm. long, 2.3 cm. broad. .....*P. distichous*

Phyllanthus caroliniensis Walt., a New Record.—A solitary specimen of this species which was found growing in shade on the left bank of Lyari river was collected from there. It has been reported for the first time from Pakistan. Its identification was confirmed by reference to the Royal Botanical Garden, Kew, England which suggests "that this species does not seem recorded so far in any of the Floras of the Old World" being reported only from the American continent. Apparently there does not seem to be any possible explanation how this species could have transmigrated over Pacific. Herbarium specimen deposited in Karachi University (Botany Department).

Identifying Characters.—A suberect herb becoming woody below, 5-36 cm. high, glabrous whorled spreading branches. Leaves obovate or oblong-ovate, 5 mm.- 1.7 cm.×5-9 mm. membranous, alternate, apex rounded or blunt. Petiole very short, 1 mm. long, glabrous. Midrib prominent with 4-5 pairs of side veins. Stipules triangular, acute, 1 mm. long, scarious at the tip and the margin. Flower monoecious, axillary pedicillate, very short 1.2-2.5 mm. (Fig. 2).

Fig. 2.—Photograph showing Phyllanthus caroliniensis Walt.

Male Flowers.—Sepals 6 obovate roundish, about .6 mm. long with white or colourless margin. Disk composed of distinct gland, filament 3, free.

Female Flowers.—Sepals linear or oblanceolate 0.6 mm.- 1 mm. increasing to 1.2 in fruits. Disk, saucer shaped. Style, free; two branched. Capsule, globular, depressed, nearly 2.1 mm. in diameter. Seeds, 3-angled, minutely papillose, about 0.8 mm. long.

Some Ecological Notes on the Distribution of Species

The area under present investigation has been divided into five ecologically separate units based on various kinds of habitat met with in this area. The distribution of species has been classified on the basis of these units which are: (1) stony hillocks, (2) sandy flats, (3) dry river beds, (4) tidal swamps and sandy sea shore and (5) cultivated fields and gardens.

I. Stony Hillocks.—Soil is mostly rocky but occasionally mixed with gravel and sand, (1) *Euphorbia caducifolia* Haines., (2) *Euphorbia clarkeana* Hook., (3) *Euphorbia granulata* Forsk., (4) *Euphorbia thymifolia* Burm., (5) *Andrachne aspera* Spreng.

II. Sandy Flats.—Soil is sandy, mixed with fine silt, (1) *Euphorbia thymifolia* Burm., (2) Euphorbia clarkeana Hook., (3) *Euphorbia caducifolia* Haines., (4) *Euphorbia granulata* Forsk., (5) *Andrachne aspera* Spreng.

III. Dry River Beds.—(a) *Malir river bed* (At the edge of guava gardens and unprotected areas): Soil is coars sand mixed with gravel, (1) *Euphorbia thymifolia* Burm., (2) *Euphorbia clarkeana* Hook., (3) *Euphorbia granulata* Forsk., (4) *Chrozophora oblongifolia* (Del) Juss.

(b) *Lyari and Hub river bed:* Soil is sandy with fine gravel and sedimentry silt, (1) *Euphorbia thymifolia* Burm., (2) *Euphorbia granulata* Forsk., (3) *Phyllanthus coroliniensis* Walt.

IV. Tidal Swamps and Saline Sandy Sea Shore.—Members of this family do not seem to thrive in swampy and saline areas. Very few individuals of *E. thymifolia* and *E. clarkeana* are seen occasionally on near by elevated areas.

V. Cultivated Fields and Gardens.—(a) Along the water channel: (1) *Phyllanthus niruri* L. sub. sp. *fraternus* (Webster) Jafri; (2) *Phyllanthus scabrifolius* Hook., (3) *Euphorbia hirta* L., (4) *Euphorbia indica* Lamk., (5) *Euphorbia geniculata* Orteg.

(b) As weed in the open field growing along with corn cultivation, (1) *Euphorbia prostrata* Ait., (2) *Euphorbia hirta* L., (3) *Euphorbia clarkeana* Hook., (4) *Fluggea leucopyrus* Willd.

(c) As weed under the shade of trees, (1) *Euphorbia hirta* L., (2) *Euphorbia indica* Lamk., (3) *Phyllanthus niruri* L. sub. sp. *fraternus* (Webster) Jafri., (4) *Chrozophora oblongfolia* (Del) Juss.

(d) Cultivated as hedges for the protection of fields, (1) *Euphorbia tirucalli* L., (2) *Ricinus communis* L.

(e) Cultivated for ornamental purposes., (1) Codiaeum variegatum Blume., (2) *Euphorbia pulcherrima* Willd., (3) *Euphorbia bojeri* Hook. f., (4) Acalypha hispida Burm., (5) *Acalypha wilkesiana* Muell., (6) *Phyllanthus distichus* Muell., (7) *Tanihot utilissima* Pohl., (8) *Jatropha pandurifolia* Andr.

Discussion

Euphorbiaceae is a large family with about 283 genera and nearly 7300 species (Lawrence 1961) distributed throughout the world but chiefly in the tropics and absent from Arctic countries (Rendle 1925). According to Rendle the centre of origin of this family is Indo-Malayan region in the Old World and Brazil in the New World which is also evident from Hooker's Flora of British India (1887). Majority of species recorded in the above flora occur in the south and east India extending east-ward to Malaya or beyond. It appears that these Indo-Malayan species prefer tropical rainy region which may be called as favourable habitat for the members of this family. The same is true for the Brazilian region in the New World.

The number of species occurring in the Indo-Pak sub-continent is comparatively low. Out of nearly 700 species ranging over about 75 genera recorded in the flora of British India only 50 species distributed among 20 genera occur in West Pakistan. In the north and north west region of Pakistan the number is higher which gradually decreases towards dry and arid region of Sind and Karachi in the south. Baluchistan has more members of the genus *Euphorbia* though it is equally dry and arid as Sind and Karachi district. However, the number of species recorded from West Pakistan appears to be more or less similar to those recorded in the adjoining countries. It appears that this small number of species is equally at home throughout the vast expanse of arid region from Rajputana desert in India extending westward to the great Sahara desert in Africa. In what manner these species of arid region are related to those of Indo-Malayan region, with such a marked variation in climatic and ecological conditions, is a matter which needs careful investigation, but there can be no doubt that most of the species of the arid and desert region are comparatively recent in origin (Bor,

1947). However 11 genera and 26 species have been reported from Karachi. Of these only 5 genera (Euphorbia, Phyllanthus, Andrachne, Chrozophora, Fluggea) and 14 species are indigenous while the rest are only cultivated or naturalized. Some of these are found either near cultivation or as garden weeds. They appear to belong to there original home in the Indo-Malayan or South-American regions but have also established in the present condition after transmigration. Some species like *Euphorbia tirucalli* and *Ricinus communis* are not indigenous to the region and are supposed to have originated in Africa from where they were introduced in this region. Both of these species are cultivated and are also naturalized near habitation. *E. tirucalli* is cultivated in N.W. India, Burma and Eastern Peninsula and is regarded as a comparatively recent introduction in Indo-Pak sub-continent. *Ricinus communis* is cultivated throughout tropics for medicinal use. An unusual mutant of *Ricinus* was also collected which differentiated from normal one in having completely smooth capsules (Figs. 3 and 4) instead of being echinate. Such a variety, though mentioned by Hooker, is very uncommon. *Phyllanthus caroliniensis* Walt. is also worth mentioning here. It is purely an American species and has been recorded for the first time by the present author. This species does not seem to have been reported in any of the Asian Flora as confirmed by the Royal Botanical Garden, Kew, England. How this transmigration might have taken place is not known and needs further investigation.

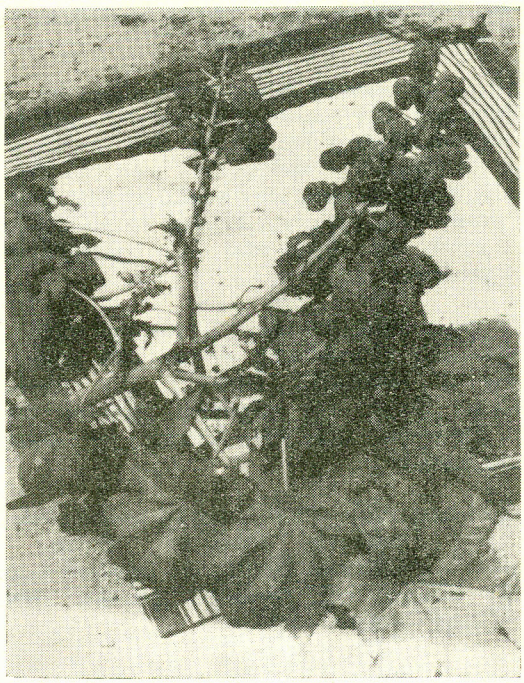

Fig. 4.—Photograph showing the unusual smooth capsules of the mutant variety of *Ricinus communis L.*

Fig. 3.—Photograph showing the normal capsules of *Ricinus communis L.*

Acknowledgements.—The author would like to thank Dr. S.Z. Hasnain for his supervision and to Dr. S.M.H. Jafri for his suggestions and permission to work on the herbarium specimens of this family in D.J. Scince College, Karachi. Thanks are also due to Meteorological Department, Government of Pakistan for providing data about climate. The author is indebted to Royal Botanical gardens for the confirmation of identification of the new record of *Phyllanthus caroliniensis* Walt. and to the Central Laboratories., Pakistan Council of Scientific and Industrial Research for providing facilities, to continue and complete the work.

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