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EXOTIC FLORISTIC COMPOSITION OF THE VARANASI DISTRICT OF UTTAR PRADESH, INDIA

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ABSTRACT

A study was conducted to analyze the exotic floristic wealth of Varanasi district of Uttar Pradesh. A total of 198 exotic plant species distributed among 157 genera belonging to 68 families were collected. The flora of American origin dominates the exotic floristic composition of the Varanasi district.

Key Words: *Exotic Flora, Green Belt Plantations, Ornamental Plants, Varanasi, Weed Flora*

INTRODUCTION

Flora refers to the botanical composition of a place where names of different species are taken into account. Flora is widely categorized into two types i.e. native flora and exotic flora. Native flora are those which exist from pre-historic times in the country while exotic flora are those which are of foreign origin. Exotic plant species have become elements of the flora of most regions of the world within last five centuries as a result of the tremendous species exchange between the continents (Nagar *et al.*, 2004). Exotic flora are either introduced intentionally or accidentally. Indo-Gangetic Plains and the Thar Desert regions of India are rich in exotic flora; however Himalayan and Peninsular regions are poor in exotic flora (Ahmad, 1999). Nearly 40% of the plant species found in India are exotic. Several studies have been conducted to explore the exotic floristic composition of a particular region in India (Nagar *et al.*, 2004; Tomar *et al.*, 2008; Singh, 2011, 2012). Therefore, the main objective of the present investigation was to explore the exotic flora of the Varanasi district of Uttar Pradesh which falls in Indo-Gangetic Plains Physiographic division of India.

MATERIALS AND METHODS

Site Description

Varanasi district is located in Eastern Uttar Pradesh and is a part of the Indo-Gangetic plains of India. The soil is alluvial type formed by the deposition of sediments of river Ganges. Soil is fertile and sandy loam in texture.

The climate is Tropical monsoonal type with three distinct seasons, the cold (November to February), the hot (March to mid June) and the rainy (mid-June to September), while October is regarded as strictly transitional month. The diurnal range of temperature ranges as average between 13°C and 14.5°C in the cold and hot months, respectively. The highest monthly temperature is recorded in May, varying between 32°C and 42°C. The annual rainfall is around 100 cm of which 90% occurs in the rainy season (Singh and Rana, 2006).

Field Survey

An extensive field survey was conducted from July 2009 to record and collect the various plant species growing in the Varanasi district. The survey was completed by the June 2010. During the survey visits were made to every nook and corner of the district in search of plant species. The identity of the plant species were confirmed through various sources (Hooker, 1875-1897; Duthie, 1903-1922; Bor, 1960; Kirtikar and Basu, 1975; Raizada, 1976). The APG III (2009) classification was followed for arranging the taxa to families.

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RESULTS AND DISCUSSION

A total of 198 exotic flora distributed among 157 genera belonging to 68 families were reported from the Varanasi district of Eastern Uttar Pradesh (Table 1). Compared to present finding, Tomar *et al.*, (2008) reported only 76 exotic plant species in flora of Baghpat district of Western Uttar Pradesh. This clearly indicates that the Eastern Uttar Pradesh is rich in exotic flora in comparison to Western Uttar Pradesh. The result conforms to the previous findings that Eastern Uttar Pradesh is rich in exotic flora (Singh, 2011, 2012). The Fabaceae, Asteraceae and Poaceae were the dominant families of the exotic flora of Varanasi district. Contrary to the result of present study Tomar *et al.*, (2008) reported the dominance of Fabaceae, Euphorbiaceae and Asteraceae families of the exotic floristic composition of Baghpat district of Western Uttar Pradesh. The study reveals that the flora of American origin (Tropical America, Central America and South America) have dominated the exotic floristic composition of the Varanasi district. Several other studies also reveal the dominance of the flora of American origin in India (Nagar *et al.*, 2004; Tomar *et al.*, 2008; Singh, 2011, 2012). A good proportion of the flora of Varanasi district is also represented by those which have their origin in Mediterranean region, Australia, China and Africa.

Table 1: Exotic flora of the Varanasi district of Uttar Pradesh, India

S.No.	Scientific Name (Family)	Habit	Place of Origin
1.	<i>Abelmoschus esculentus</i> Moench. (Malvaceae)	Shrub	Africa
2.	<i>Acacia arabica</i> Willd. (Fabaceae)	Tree	Africa
3.	<i>Acacia auriculiformis</i> A. Cunn. ex Benth (Fabaceae)	Tree	Australia
4.	<i>Acacia mangium</i> Willd. (Fabaceae)	Tree	Australia
5.	<i>Acacia melanoxylon</i> R. Br. (Fabaceae)	Tree	Australia
6.	<i>Acacia senegal</i> Willd. (Fabaceae)	Tree	Tropical Africa
7.	<i>Acacia tortilis</i> (Forsk.) Hayne (Fabaceae)	Tree	Africa
8.	<i>Agave americana</i> Linn. (Asparagaceae)	Herb	Central America
9.	<i>Agave wightii</i> Drum. & Prain. (Asparagaceae)	Herb	West Indies
10.	<i>Ageratum conyzoides</i> Linn. (Asteraceae)	Herb	Central America
11.	<i>Allamanda cathartica</i> Linn. (Apocynaceae)	Climbing shrub	Tropical America
12.	<i>Allamanda neriifolia</i> Hook. (Apocynaceae)	Climbing shrub	Tropical America
13.	<i>Allium cepa</i> Linn. (Amaryllidaceae)	Herb	China
14.	<i>Aloe vera</i> (Linn.) Burm. (Xanthorrhoeaceae)	Shrub	Mediterranean region
15.	<i>Alternanthera sessilis</i> (Linn.) DC (Amaranthaceae)	Herb	Tropical America
16.	<i>Althea rosea</i> (Linn.) Cav	Undershrub	Greece

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	(Malvaceae)		
17.	<i>Amaranthus spinosus</i> Linn. (Amaranthaceae)	Herb	America
18.	<i>Anacardium occidentale</i> Linn. (Anacardiaceae)	Tree	West Indies and Brazil
19.	<i>Anagallis arvensis</i> Linn. (Myrsinaceae)	Herb	Europe
20.	<i>Anethum graveolens</i> Linn. (Apiaceae)	Herb	Eurasia
21.	<i>Annona squamosa</i> Linn (Annonaceae)	Tree	Tropical America
22.	<i>Antigonon leptopus</i> Hook. & Arn. (Polygonaceae)	Climbing Herb	South America
23.	<i>Antirrhinum majus</i> Linn. (Scrophulariaceae)	Herb	Mediterranean region
24.	<i>Arachis hypogaea</i> Linn. (Fabaceae)	Herb	Brazil
25.	<i>Argemone mexicana</i> Linn. (Papavaraceae)	Herb	Ethiopia
26.	<i>Artocarpus communis</i> Forst (Moraceae)	Tree	Malaysia and Pacific Islands
27.	<i>Asparagus officinalis</i> Linn. (Asparagaceae)	Herb	Mediterranean region
28.	<i>Asparagus racemosus</i> Willd. (Asparagaceae)	Climbing herb	Sri Lanka
29.	<i>Avena sativa</i> Linn. (Poaceae)	Herb	Asia Middle East
30.	<i>Bauhinia purpurea</i> Linn. (Fabaceae)	Tree	West Indies
31.	<i>Beta vulgaris</i> Linn. (Chenopodiaceae)	Herb	Mediterranean region
32.	<i>Borassus flabellifer</i> Linn. (Arceaceae)	Tree	Tropical Africa
33.	<i>Bougainvillea buttiana</i> Willd. (Nyctaginaceae)	Shrub	South America
34.	<i>Bougainvillea glabra</i> Choisy (Nyctaginaceae)	Shrub	South America
35.	<i>Bougainvillea</i> hybrid (Nyctaginaceae)	Shrub	South America
36.	<i>Bougainvillea peruviana</i> Willd. (Nyctaginaceae)	Shrub	South America
37.	<i>Bougainvillea spectabilis</i> Willd. (Nyctaginaceae)	Shrub	Brazil
38.	<i>Brassica nigra</i> Koch (Brassicaceae)	Herb	Eurasia
39.	<i>Brassica oleracea</i> Linn. var. <i>botrytis</i> (Brassicaceae)	Herb	Mediterranean region
40.	<i>Brassica oleracea</i> Linn. var. <i>capitata</i> (Brassicaceae)	Herb	Mediterranean region

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41.	<i>Brassica oleracea</i> Linn. var. <i>caulorapa</i> (Brassicaceae)	Herb	Mediterranean region
42.	<i>Brassica oleracea</i> Linn. var. <i>gemmifera</i> (Brassicaceae)	Herb	Mediterranean region
43.	<i>Brassica oleracea</i> Linn. var. <i>gongylodes</i> Linn. (Brassicaceae)	Herb	Mediterranean region
44.	<i>Cajanus cajan</i> (Linn.) Mill (Fabaceae)	Shrub	Africa
45.	<i>Calendula officinalis</i> Linn. (Asteraceae)	Herb	South Europe and Australia
46.	<i>Callistemon lanceolatus</i> Sweet (Myrtaceae)	Tree	Australia
47.	<i>Canna indica</i> Linn. (Cannaceae)	Herb	Africa
48.	<i>Capsicum annuum</i> Linn. (Solanaceae)	Herb	South America
49.	<i>Carica papaya</i> Linn. (Caricaceae)	Herb	Mexico
50.	<i>Carissa carandas</i> Linn. (Apocynaceae)	Shrub	South Africa
51.	<i>Cassia occidentalis</i> Linn. (Fabaceae)	Shrub	South America
52.	<i>Cassia siamea</i> Lam. (Fabaceae)	Tree	Myanmar
53.	<i>Cassia tora</i> Linn. (Fabaceae)	Herb	South America
54.	<i>Casuarina equisetifolia</i> Forst. (Casuarinaceae)	Tree	Australia
55.	<i>Catharanthus roseus</i> (Linn.) G. Don (Apocynaceae)	Herb	Madagascar
56.	<i>Cerbera manghas</i> Linn. (Apocynaceae)	Shrub	West Indies
57.	<i>Chamaerops humilis</i> Linn. (Arecaceae)	Tree	Europe
58.	<i>Chenopodium album</i> (Linn.) G. Don (Chenopodiaceae)	Herb	Mexico
59.	<i>Chloris barbata</i> Sweet (Poaceae)	Herb	Tropical America
60.	<i>Chrysanthemum carinatum</i> Linn. (Asteraceae)	Herb	Japan
61.	<i>Chrysanthemum cinerariaefolium</i> Vis. (Asteraceae)	Herb	Japan
62.	<i>Chrysanthemum coronarium</i> Linn. (Asteraceae)	Herb	Japan
63.	<i>Chrysanthemum marifolium</i> Ramat (Asteraceae)	Herb	Japan
64.	<i>Chrysanthemum</i> hybrid (Asteraceae)	Herb	Japan and China
65.	<i>Cicer arietinum</i> Linn.	Herb	South Europe

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66.	(Fabaceae) <i>Cichorium intybus</i> Linn.	Herb	Europe
67.	(Asteraceae) <i>Citrullus vulgaris</i> Stroks (Cucurbitaceae)	Herb	West Africa
68.	<i>Citrus lemon</i> (L.) Burm (Rutaceae)	Tree	South eastern Asia
69.	<i>Citrus reticulata</i> Blanco. (Rutaceae)	Tree	China
70.	<i>Clitoria ternatea</i> Linn. (Fabaceae)	Climbing herb	Tropical America
71.	<i>Coleus blumei</i> Benth. (Lamiaceae)	Herb	Indonesia
72.	<i>Colocasia antiquorum</i> Linn. (Araceae)	Herb	China
73.	<i>Convolvulus arvensis</i> Linn. (Convolvulaceae)	Herb	Europe
74.	<i>Corchorus aestuans</i> Linn. (Tiliaceae)	Herb	Tropical America
75.	<i>Coriandrum sativum</i> Linn. (Apiaceae)	Herb	Mediterranean region
76.	<i>Crotalaria medicaginea</i> Linn. (Fabaceae)	Herb	South East Europe
77.	<i>Croton bonplandianum</i> Baill. (Euphorbiaceae)	Herb	South America
78.	<i>Cryptostegia grandiflora</i> (Roxb.) R.Br. (Periplocaceae)	Shrub	Tropical Africa
79.	<i>Cuminum cyminum</i> Linn. (Apiaceae)	Herb	Mediterranean region
80.	<i>Cynodon dactylon</i> (L) Pers. (Poaceae)	Herb	Tropical America
81.	<i>Cyperus rotundus</i> Linn. (Cyperaceae)	Herb	Eurasia
82.	<i>Datura metel</i> Linn. (Solanaceae)	Undershrub	Tropical America
83.	<i>Daucus carota</i> Linn. (Apiaceae)	Herb	Mediterranean region
84.	<i>Delonix regia</i> (Boj) Raf. (Fabaceae)	Tree	Madagascar
85.	<i>Dolichos lablab</i> Linn. (Fabaceae)	Climbing shrub	Ethiopia
86.	<i>Eclipta prostrata</i> Linn. (Asteraceae)	Herb	South America
87.	<i>Eichhornia crassipes</i> Solms. (Pontederiaceae)	Herb	Brazil
88.	<i>Eragrostis tenella</i> (L.) Beauv. ex Roem & Schult (Poaceae)	Herb	Africa
89.	<i>Eucalyptus rostrata</i> Cad. (Myrtaceae)	Tree	Australia

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90.	<i>Eucalyptus citriodora</i> Hook. (Myrtaceae)	Tree	Australia
91.	<i>Eucalyptus globulus</i> Labill (Myrtaceae)	Tree	Australia
92.	<i>Eucalyptus</i> hybrid (Myrtaceae)	Tree	Australia
93.	<i>Eucalyptus tereticornis</i> Smith (Myrtaceae)	Tree	Australia
94.	<i>Euphorbia hirta</i> Linn. (Euphorbiaceae)	Herb	Tropical America
95.	<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch. (Euphorbiaceae)	Shrub	Mexico
96.	<i>Euphorbia thymifolia</i> Linn. (Euphorbiaceae)	Herb	Tropical America
97.	<i>Ficus carica</i> Linn. (Moraceae)	Tree	Middle East
98.	<i>Gladiolus</i> hybrid (Iridaceae)	Herb	South Africa
99.	<i>Gomphrena globosa</i> Linn (Amarthaceae)	Herb	America
100.	<i>Grevillea pteridifolia</i> Knight (Proteaceae)	Tree	Australia
101.	<i>Grevillea robusta</i> A. cunn. ex. R. Br. (Proteaceae)	Tree	Australia
102.	<i>Grewia subinaequalis</i> DC (Tiliaceae)	Shrub	Sri Lanka
103.	<i>Guizotia abyssinica</i> (L. f.) Cass (Asteraceae)	Herb	Tropical Africa
104.	<i>Helianthus annuus</i> Linn. (Asteraceae)	Herb	America
105.	<i>Heliotropium indicum</i> Linn. (Boraginaceae)	Herb	South America
106.	<i>Hibiscus rosa-sinensis</i> Linn. (Malvaceae)	Shrub	China
107.	<i>Holoptelea integrifolia</i> (Roxb.) Planch. (Ulmaceae)	Tree	Pacific islands
108.	<i>Hordeum vulgare</i> Linn. (Poaceae)	Herb	Ethiopia
109.	<i>Ipomoea batata</i> Lamk. (Convolvulaceae)	Climbing herb	Tropical America
110.	<i>Ipomoea fistulosa</i> Mart. (Convolvulaceae)	Shrub	South America
111.	<i>Ipomoea quamoclit</i> Linn. (Convolvulaceae)	Herb	Tropical America
112.	<i>Iseilema laxum</i> Hoch. (Poaceae)	Herb	Tropical America
113.	<i>Jatropha curcus</i> Linn. (Euphorbiaceae)	Tree	Tropical America
114.	<i>Jatropha gossypifolia</i> Linn.	Shrub	Brazil

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115.	(Euphorbiaceae) <i>Jatropha panduraefolia</i> Andr.	Shrub	South America
116.	(Euphorbiaceae) <i>Jatropha podagrica</i> Hook.	Shrub	Tropical America
117.	(Acanthaceae) <i>Justicia gendarussa</i> Burn.	Herb	China
118.	(Crassulaceae) <i>Kalanchoe pinnata</i> (Lam.) Merr.	Herb	Tropical Africa
119.	(Bignoniaceae) <i>Kigelia africana</i> (Lam.) Benth.	Tree	Tropical Africa
120.	(Asteraceae) <i>Lactuca sativa</i> Linn.	Herb	Mediterranean region
121.	(Asteraceae) <i>Lactuca seriola</i> Linn.	Herb	Mediterranean region
122.	(Verbenaceae) <i>Lantana camara</i> Linn.	Shrub	America
123.	(Lythraceae) <i>Lawsonia inermis</i> Linn.	Shrub	Northern Africa
124.	(Fabaceae) <i>Lens esculenta</i> Moench	Herb	Mediterranean region
125.	(Fabaceae) <i>Leucaena latisiqua</i> Linn.	Tree	Tropical America
126.	(Fabaceae) <i>Leucaena leucocephala</i> Willd.	Tree	Tropical America
127.	(Linaceae) <i>Linum usitatissimum</i> Linn.	Herb	Central Asia
128.	(Sapindaceae) <i>Litchi chinensis</i> (Gaertn.) Sonn.	Tree	China
129.	(Arecaceae) <i>Livistona chinensis</i> R. Br.	Tree	China
130.	(Solanaceae) <i>Lycopersicon esculentum</i> Linn.	Herb	South America
131.	(Sapotaceae) <i>Manilkara zapota</i> (L.) van Royen	Tree	South America
132.	(Martyniaceae) <i>Martynia annua</i> Linn.	Herb	Mexico
133.	(Fabaceae) <i>Medicago sativa</i> Linn.	Herb	Middle east
134.	(Meliaceae) <i>Melia azedarach</i> Linn.	Tree	Iran
135.	(Fabaceae) <i>Melilotus alba</i> Desr.	Herb	Eurasia
136.	(Bignoniaceae) <i>Millingtonia hortensis</i> Linn.	Tree	Malaysia
137.	(Fabaceae) <i>Mimosa pudica</i> Linn.	Tree	Brazil
138.	(Nyctaginaceae) <i>Mirabilis jalapa</i> Linn.	Herb	Tropical America

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139.	<i>Morus alba</i> Linn. (Moraceae)	Tree	China
140.	<i>Morus nigra</i> Linn. (Moraceae)	Tree	China
141.	<i>Mussaenda luteola</i> Delile (Rubiaceae)	Shrub	America and West Indies
142.	<i>Nicotiana plumbaginifolia</i> Viv. (Solanaceae)	Herb	Tropical America
143.	<i>Ocimum americanum</i> Linn. (Lamiaceae)	Herb	Africa
144.	<i>Opuntia elatior</i> Mill. (Cactaceae)	Shrub	South America
145.	<i>Oxalis corniculata</i> Linn. (Oxalidaceae)	Herb	Southern Europe and North America
146.	<i>Panicum miliaceum</i> Linn. (Poaceae)	Herb	China
147.	<i>Parkinsonia aculeata</i> Linn. (Fabaceae)	Tree	Mexico
148.	<i>Parthenium hysterophorus</i> Linn. (Asteraceae)	Herb	Tropical America
149.	<i>Passiflora edulis</i> Sims. f. (Passifloraceae)	Climbing herb	Brazil
150.	<i>Passiflora foetida</i> Linn. (Passifloraceae)	Climbing herb	South America
151.	<i>Peltophorum pterocarpum</i> Backer ex Heyne (Caesalpiaceae)	Tree	Sri Lanka and Malaysia
152.	<i>Pennisetum typhoides</i> (Burm.) Stapf & Hubbard (Poaceae)	Herb	Africa
153.	<i>Phalaris minor</i> Retz. (Poaceae)	Herb	America
154.	<i>Phaseolus lunatus</i> Linn. (Fabaceae)	Herb	Tropical America
155.	<i>Phaseolus vulgaris</i> Linn. (Fabaceae)	Herb	America
156.	<i>Phoenix sylvestris</i> Roxb. (Arecaceae)	Tree	West Asia
157.	<i>Physalis minima</i> Linn. (Solanaceae)	Herb	South America
158.	<i>Physalis peruviana</i> Linn. (Solanaceae)	Herb	Tropical America
159.	<i>Pithecolobium dulce</i> (Roxb.) Benth. (Fabaceae)	Tree	Central and South America
160.	<i>Plumeria rubra</i> Linn (Apocynaceae)	Tree	South America
161.	<i>Polianthes tuberosa</i> Linn. (Amaryllidaceae)	Herb	Mexico
162.	<i>Populus deltoides</i> Linn. (Salicaceae)	Tree	America
163.	<i>Portulaca oleracea</i> Linn.	Herb	North Africa and

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	(Portulacaceae)		Europe
164.	<i>Prosopis juliflora</i> (Sw.) DC (Fabaceae)	Tree	Central sAmerica
165.	<i>Prunus amygdalus</i> Batsch (Rosaceae)	Tree	Mediterranean region
166.	<i>Psidium guajava</i> Linn. (Myrtaceae)	Tree	South America
167.	<i>Punica granatum</i> Linn. (Lythraceae)	Tree	Iran, Afghanistan
168.	<i>Quisqualis indica</i> Linn. (Combretaceae)	Climbing shrub	Malaysia
169.	<i>Raphanus sativus</i> Linn. (Brassicaceae)	Herb	China
170.	<i>Ravenala madagascariensis</i> Gmel. (Musaceae)	Herb	Madagascar
171.	<i>Rhoeo discolor</i> Hance (Commelinaceae)	Herb	Central America
172.	<i>Ricinus communis</i> Linn. (Euphorbiaceae)	Shrub	Africa
173.	<i>Ruellia tuberosa</i> Linn. (Acanthaceae)	Herb	Tropical America
174.	<i>Samanea saman</i> Merr. (Fabaceae)	Tree	Central America
175.	<i>Sesamum indicum</i> Linn. (Passifloraceae)	Herb	Tropical Africa
176.	<i>Sesbania sesban</i> (Linn.) Merr. (Fabaceae)	Shrub	Southern Africa
177.	<i>Solanum tuberosum</i> Linn. (Solanaceae)	Herb	Peru
178.	<i>Sonchus oleraceus</i> Linn. (Asteraceae)	Herb	Europe
179.	<i>Sphaeranthus indicus</i> Linn. (Asteraceae)	Herb	Africa
180.	<i>Sporobolus diander</i> (Retz.) P. Beauv (Poaceae)	Herb	Australia
181.	<i>Swietenia mahagonii</i> Jacq. (Meliaceae)	Tree	West Indies
182.	<i>Tagetes erecta</i> Linn. (Asteraceae)	Herb	Mexico
183.	<i>Tagetes patula</i> Linn. (Asteraceae)	Herb	Mexico
184.	<i>Tamarindus indica</i> Linn. (Fabaceae)	Tree	Tropical Africa
185.	<i>Tamarix aphylla</i> (Linn.) Karst (Tamaricaceae)	Tree	Africa and Australia
186.	<i>Taraxacum officinalae</i> F. H. Wigg. (Asteraceae)	Herb	Europe
187.	<i>Tecoma stans</i> (Linn.) H.B.K. nov (Bignoniaceae)	Tree	America

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188.	<i>Terminalia catappa</i> Linn. (Combretaceae)	Tree	Malaysia
189.	<i>Thevetia peruviana</i> Schum. (Apocynaceae)	Shrub	South America
190.	<i>Tridax procumbens</i> Linn. (Asteraceae)	Herb	Mexico
191.	<i>Trifolium alexandrinum</i> Linn. (Fabaceae)	Herb	Italy
192.	<i>Trigonella foenum-graecum</i> Linn. (Fabaceae)	Herb	East Africa
193.	<i>Urena lobata</i> Linn. (Malvaceae)	Herb	Africa
194.	<i>Vigna sinensis</i> (Linn.) Savien Hassk (Fabaceae)	Herb	Central Africa
195.	<i>Vitis vinifera</i> Linn. (Vitaceae)	Woody climber	South East Europe
196.	<i>Withania somnifera</i> (Linn.) Dunal (Solanaceae)	Herb	Mediterranean region
197.	<i>Zea mays</i> Linn. (Poaceae)	Herb	America
198.	<i>Ziziphus mauritiana</i> Lamk. (Rhamnaceae)	Tree	China

The most common flora of Australian origin were represented by *Acacia arabica*, *A. mangium*, *A. auriculiformis*, *Eucalyptus citriodora*, *E. globulus*, *E. hybrid*, *E. tereticornis*, *Casuarina equisetifolia*, *Grevillea robusta*, *G. pteridifolia* and *Callistemon lanceolatus*.

A large number of exotic flora of Varanasi district are represented by weeds of agricultural fields. These include *Ageratum conyzoides*, *Alternanthera sessilis*, *Amaranthus spinosus*, *Anagallis arvensis*, *Argemone mexicana*, *Cassia tora*, *Chenopodium album*, *Convolvulus arvensis*, *Corchorus aestuans*, *Crotalaria medicaginea*, *Croton bonplandianum*, *Cynodon dactylon*, *Cyperus rotundus*, *Datura metel*, *Eragrostis tenella*, *Euphorbia hirta*, *E. thymifolia*, *Heliotropium indicum*, *Lactuca seriola*, *Martynia annua*, *Melilotus alba*, *Mimosa pudica*, *Nicotiana plumbaginifolia*, *Oxalis corniculata*, *Parthenium hysterophorus*, *Physalis minima*, *Ruellia tuberosa*, *Sonchus oleraceus*, *Sphaeranthus indicus*, *Sporobolus diander*, *Taraxacum officinalae*, *Tridax procumbens* and *Urena lobata*. These exotic plant species have naturalized in Indian conditions and are growing successfully.

Exotics are often referred to as "biological pollutants" due to their destructive effects on natural and man-managed ecosystems (Westbrooks, 1991). Among all reported exotic weed flora of Varanasi district *Parthenium hysterophorus* and *Eichhornia crassipes* were the only two exotic flora which have detrimental effects on natural and agro-ecosystems. *P. hysterophorus* seemed a devastating weed of terrestrial ecosystems while *E. crassipes* is a destructive weed of aquatic ecosystems in Varanasi district. The scourge of *E. crassipes* increases several fold in rainy season.

Several of the exotic flora were represented by the crop plants. The notable examples are *Arachis hypogaea*, *Cajanus cajan*, *Guizotia niger*, *Helianthus annuus*, *Hordeum vulgare*, *Lens esculenta*, *Linum usitatissimum*, *Panicum miliaceum*, *Pennisetum typhoides*, *Phaseolus vulgaris* and *Zea mays*.

A good number of exotics were also represented by vegetable crops which include *Abelmoschus esculentus*, *Allium cepa*, *Beta vulgaris*, *Brassica botrytis*, *B. capitata*, *B. caulorapa*, *B. gemmifera*, *B. gongylodes*, *Capsicum annum*, *Colocasia antiquorum*, *Dolichos lablab*, *Lycopersicon esculentum*, *Raphanus sativus*, *Solanum tuberosum*, *Trigonella foenum-graecum* and *Vigna sinensis*.

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The exotics representing the common ornamental plants of Varanasi district include *Agave americana*, *A wightii*, *Allamanda cathartica*, *A. neriifolia*, *Aloe vera*, *Asparagus officinalis*, *A. racemosus*, *Bauhinia purpurea*, *Bougainvillea buttiana*, *B. glabra*, *B. hybrid*, *B. peruviana*, *B. spectabilis*, *Calendula officinalis*, *Catharanthus roseus*, *Chamaerops humilis*, *Chrysanthemum carinatum*, *C. cinerariaefolium*, *C. coronarium*, *C. marifolium*, *C. hybrid*, *Clitoria ternatea*, *Euphorbia pulcherrima*, *Gladiolus hybrid*, *Hibiscus rosa-sinensis*, *Ipomoea quamoclit*, *Jatropha panduraefolia*, *J. podagrica*, *Justicia gendarussa*, *Kalanchoe pinnata*, *Kigelia Africana*, *Lawsonia inermis*, *Livistonia chinensis*, *Mirabilis jalapa*, *M. luteola*, *Passiflora edulis*, *Plumeria rubra*, *Polyanthes tuberosa*, *Quisqualis indica*, *Ravenala madagascariensis*, *Rhoeo discolor*, *Tagetes erecta*, *T. patula* and *Thevetia peruviana*.

The most common exotic plant species of green belt plantations of Varanasi district are represented by *Acacia auriculiformis*, *A. mangium*, *Cassia siamea*, *Delonix regia*, *Grevillea robusta* and *G. pteridifolia*. Though *Eucalyptus* plantation is banned since last one decade due to its several side effects (allelopathy, depletion of sub-soil water etc.), however the old plantations of *Eucalyptus globulus*, *E. tereticornis*, *E. citriodora*, *E. rostrata* and *E. hybrid* can be noticed along the highways of the Varanasi district. In addition to *Eucalyptus*, *Prosopis juliflora*, *Acacia arabica*, *A. auriculiformis* and *A. tortilis* are the other exotic flora which can be observed along the highways of the Varanasi district.

The common fruit yielding exotic flora of Varanasi district are represented by *Annona squamosa*, *Artocarpus communis*, *Carica papaya*, *Citrullus vulgaris*, *Citrus reticulata*, *Ficus carica*, *Grewia subinaequalis*, *Litchi chinensis*, *Manilkara zapota*, *Morus alba*, *M. nigra*, *Physalis peruviana*, *Psidium guajava*, *Punica granatum*, *Vitis vinifera* and *Ziziphus mauritiana*.

A large number of exotic plants are used as herbal medicines by the rural folks of the Varanasi district. The important ones include *Acacia arabica*, *Allium cepa*, *Aloe vera*, *Argemone mexicana*, *Asparagus racemosus*, *Bauhinia purpurea*, *Carica papaya*, *Cassia occidentalis*, *Cichorium intybus*, *Citrus lemon*, *Colocasia antiquorum*, *Convolvulus arvensis*, *Coriandrum sativum*, *Cynodon dactylon*, *Datura metel*, *Eclipta prostrata*, *Hibiscus rosa-sinensis*, *Ipomoea fistulosa*, *Lawsonia inermis*, *Mentha arvensis*, *Punica granatum*, *Raphanus sativus*, *Ricinus communis*, *Sphaeranthus indicus*, *Tagetes erecta*, *T. patula*, *Trigonella foenum-graecum* and *Ziziphus mauritiana*.

CONCLUSION

It can be concluded from the study that Varanasi district of Uttar Pradesh is rich in exotic flora. The Fabaceae, Asteraceae and Poaceae are the dominant families of exotic flora of the Varanasi district. The flora of American origin dominates the exotic floristic composition of the Varanasi district of Uttar Pradesh.

REFERENCES

- Ahmad A (1999).** *India: A General Geography*. (N.C.E.R.T. Publications, New Delhi, India) 66-76.
- APG III (2009).** An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. APG III. *Botanical Journal of Linnean Society* **161** 105-121.
- Bor NL (1960).** *The Grasses of Burma, Ceylon, India and Pakistan*, Pergamon Press, Oxford.
- Duthie JF (1903-1922).** *Flora of the Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts*. 3 Vols. (Govt. of India, Central Publication Branch, Calcutta, India).
- Hooker JD (1875-1897).** *Flora of British India*. 7 Vols. (L. Reeve and Co., London, U.K).
- Kirtikar KR and BD Basu (1975).** *Indian Medicinal Plants* 4 Vols. Bishan Singh, Mahendra Pal Singh, Dehra Dun, India.
- Nagar PS, SJ Pathak and SM Pandya (2004).** The alien flora of the Barda hills and its surroundings in Gujarat, India. *Indian Journal of Forestry* **27**(1) 25-38.
- Raizada MB (1976).** *Supplement to the Flora of Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts*. Bishan Singh Mahendra Pal Singh, Dehradun, India.

Research Article

Singh A (2011). Exotic flora of the Banaras Hindu University main campus, India. *Journal of Ecology and the Natural Environment* **3**(10) 337-343.

Singh A (2012). Exotic flora of the Chandauli district Uttar Pradesh, India: An Overview. *Indian Journal of Forestry* **35** (1) 79-84.

Singh RP B and P S Rana (2006). The holy city of Varanasi. NATCON-IASO-WFSOS, *Department of Surgical Oncology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India* 49-61.

Tomar A, H Singh and V Singh (2008). Exotic elements in the flora of Baghpat district, Uttar Pradesh. *Indian Journal of Forestry* **31**(3) 463-471.

Westbrooks R (1991). Plant protection issues I. A commentary on new weeds in the United States. *Weed Technology* **5** 232-237.