

A New Record to the Flora of Saudi Arabia: *Ipomoea carnea* Jacq., Convolvulaceae

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Abstract— *Ipomoea carnea* Jacq. (Family Convolvulaceae) form Jazan, Saudi Arabia is described as a new record species to the flora of Saudi Arabia. The farmers use it as ornamental and hedge plant along the edge of their farm. The rapid growth rate, spread, and adaptability from aquatic to xerophytic habitats indicate that this plant may potentially become an invasive species in the next decade in that area and may cause other ecological disaster. Besides causing problems as a pasture weed, *I. carnea* is reported to be a toxic plant.

Index Terms— Flora, *Ipomoea carnea*, naturalized species, Saudi Arabia.

I. INTRODUCTION

During the past 30 years, however, *Ipomoea carnea* has been repeatedly noticed forming large naturalized population in India [1&2], where it is rapidly spreading throughout the subcontinent [3&4]. It is a native of tropical South America which attained pan tropical distribution [5], probably because of its use as an ornamental and in grafting of sweet potato [*Ipomoea batatas* (L.) Lam.] cultivars and occur in open unshaded areas subject to shallow seasonal flooding lasting up to six months. Its large leaves and large scented, rose-purple flowers make it an attractive plant for cultivation in tropical and subtropical climates [6]. It was also introduced to India at the end of the last century as a garden and hedge plant [7]. Since then, it has become a weed and spread rapidly on land in many habitats and in water. This plant has rapid growth rate, spread and adaptability from aquatic to xerophytic habitats [1].

As quoted by [8], *Ipomoea carnea* is very common throughout the American tropics, ranging from Argentina to the southern states of U.S.A. It also spread in Dallas, Texas and the southern part of Georgia in U.S.A. [9]. The plant is considered to have its origin in the Pantanal of Bolivia, Brazil and Paraguay; i.e. the floodplains of the upper Rio Paraguai stretching from Corrientes (28°S) in Argentina to the Parque Nacional Noel Kempff (15°S) in Bolivia [10, 11, 12, 13 & 14]. As in many other countries, it has been also introduced and cultivated in other provinces of Argentina, Brazil and Bolivia [6]. It has not been reported for Barbados [15], Barro Colorado Island [16], and the Galápagos Islands [17].

Verdcourt [18] reported cultivated specimens of *Ipomoea carnea* from Nairobi, Kenya and naturalized populations along the coast of tropical East Africa. It has also been reported from India [2, 19&20], West-Pakistan [21], Sri

Lanka [22], the Malayan archipelago, Java in Indonesia [23], Okinawa [24] and Taiwan [25]. *Ipomoea carnea* today may be considered a pantropical weed, its pantropical distribution is presumably the result of cultivations. Generally it is distributed in the Egyptian Nile region include the Nile Delta, Valley and Faiyum along the canal banks and in moist waste ground [26, 27, 28 & 29]. It has not been reported for Barbados [15], Barro Colorado Island [16], the Galápagos Islands [17] and Saudi Arabia [30, 31, 32, 33, 34, 35, 36 & 37].

Cook [3] observed that *Ipomoea carnea* grows on dry rocks as well as on the banks of lakes and rivers, in water up to 2 m deep or as components of floating islands in the Pantanal. Also, [2] and [6] indicated a wide ecological amplitude for this plant as much as they observed it growing in xeric and hydric conditions. This plant was found growing in sandy and silty, nutrient-poor and organic, xeric and hydric conditions, while the plant seemed to prosper best in hydric, nutrient-rich conditions. Shade tolerance was not observed [6].

Ipomoea carnea contributes to the mosquito nuisance [38]. The high cellulose and volatile solid content of dried stem material is responsible for its successful biogasification [39 & 40]. This plant can be used as a source of green manure due to the addition of essential nutrients to the soil by the leaf incorporation which finally helped the increasing of grain yield. It is used in farm land for improving the soil fertility in tropical countries like India where it is prevalent [41]. Aqueous flower extracts at 5% or higher of this plant showed the greatest nematocidal properties against the second stage of *Meloidogyne incognita* [42]. Aqueous extracts of dried and powdered corolla, senescent leaves and roots of it inhibit the shoot and root growth of wheat, sorghum, rice and kidney bean [43]. The changes in leaf surface traits can be used as air pollution marker [44]. Leaf surface also can be used as dust scavengers [45]. The leaves are palatable for various fish species [6]. The latex of the plant is used in traditional medicine as a topical antiseptic in lesions [46]. Extracts prepared from whole plant in hot, not boiling water seem to be a widely used as antirheumatic remedy in Bolivia. A new use of entire *Ipomoea carnea* as a raw material for paper-bag production in the surroundings of Tiruchirapalli and along the Eastern Ghats in India was reported by [6]. He reported a rare use of dried stem material as fire-wood in Rajasthan, because of its yellow flame. The use of plant against dermatoses without referring to any sources was reported by [47]. Also the wood of the stems can be used in turneries, which seems doubtful considering the low amount of lignin in the soft wood [40]. It can also cause some problems such as obstruction and difficulties in the proper use of the irrigation, navigation, and fisheries [38], poisoning and its effects on the nervous system [48 & 49] and

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toxicity in goats [50]. In Egypt, the farmers use *I. carnea* as ornamental and hedge plant along the banks of irrigation and drainage canals [29].

A total of 2284 species including naturalized and alien plants have been reported from various habitats of Saudi Arabia alone [51]. These records not only furnish an important baseline for the floristic elements but also give an authoritative knowledge about the distribution of these species. However, during the last few years, botanists and enthusiastic plant collectors have encountered several taxa new to the flora of Saudi Arabia, some of them turned out to be new species [52, 53 & 54], while others are reported as new records [52, 55, 56, 57, 58, 59, 60 & 61]. As some of the areas in Saudi Arabia are apparently under-collection, one can come across with many more unexpected species previously not recorded for the flora of Saudi Arabia. Detailed study of a few of the specimens collected during the recent field explorations turned out to be species hitherto unknown to Saudi Arabia. The present paper deals with updated nomenclature, detailed morphological description, phenology, habitat, and distribution of the species. The aim of this contribution is to provide supplementary data on the existing vascular plant records and to outline the taxonomic and phytogeographical background of these newly discovered species.

II. MATERIAL AND METHODS

During field explorations in the Saudi Arabia kingdom in Feb, 2015, the specimens of *Ipomoea carnea* were collected by the author. The digital photos of the plant in its natural habitat were taken to confirm the identification. Data on plant populations and habitats were also gathered during the expeditions. A Garmin GPS 72H was used for the geographic coordinates of the collecting sites. The collected data was downloaded and processed with the Google Earth. The identification and corroboration were performed with different relevant floras [27 & 62].

III. RESULTS AND DISCUSSION

During field explorations in the Saudi Arabia kingdom in Feb, 2015, *Ipomoea carnea* was recorded for the first time at the Dahia site at Jazan province, Saudi Arabia in farms as a fence (17° 04.433 - 17° 05.555 N and 42° 33.432 - 42° 38.0189 E), where it grows at the edges of some farms of Jazan region. Furthermore, after going through the literatures [30, 31, 32, 33, 34, 35, 36 & 37], it has been confirmed that *Ipomoea carnea* was new record to the flora of Saudi Arabia. The recorded sites of *Ipomoea carnea* are presented in Fig. 1 and Table 1. In these sites, the plant occurred in large members and established a viable population (Fig. 2). By asking the stakeholders, they indicated that the plant was introduced from Egypt by farmers who work in the farms distributed in this area.

It was important to mention that this plant propagates vegetatively by stems which are capable of rooting within a few days as well as by seeds. The rapid growth rate, spread, and adaptability from aquatic to xerophytic habitats indicate that this plant may potentially become an invasive species in that area and may cause other ecological disaster. Also, [29] reported that the rapid spread

of *I. carnea* indicates a successful invasion capability, which could be attributed to: (1) its ability to propagate

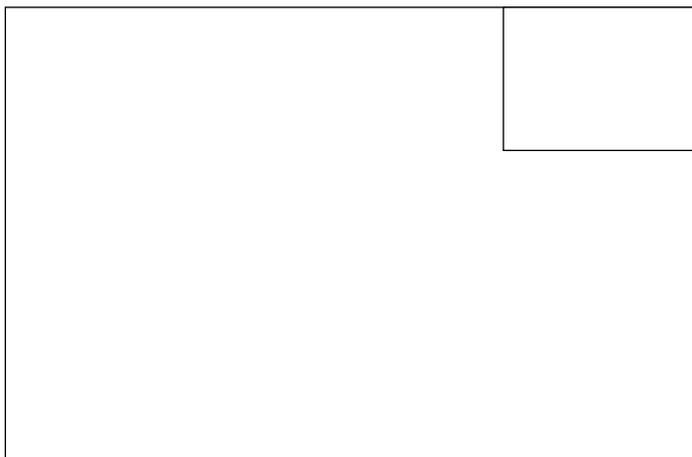


Fig. 1. Map showing the transect which *Ipomoea carnea* recorded

Table 1. Coordinates of the recorded site of *Ipomoea carnea* at Jazan region, KSA.

Site No.	Latitude	Longitude	Phenology
1	17° 05.555	42° 38.0189	Flowering
2	17° 05.424	42° 37.690	Flowering
3	17° 05.045	42° 36.559	Flowering
4	17° 04.140	42° 36.159	Flowering
5	17° 04.433	42° 33.432	Flowering
6	17° 04.812	42° 32.434	Flowering

vegetatively by stems, which can set root within few days, (2) decumbent branches root in the soil and grow upwards giving new ramets, (3) ornamental hedges are prepared by planting stem cuttings, which facilitates the invasion of new regions, (4) during floods, plants are swept off river beds and embankments and become established in downstream habitats and (5) efficient reproduction by seed [38]. Besides causing problems as a pasture weed, *I. carnea* is reported to be a toxic plant [63].

The brief below descriptions of the new recorded species is based on various studies as well as our collected specimens from Jazan region, KSA.

A. Synonyms and Nomenclature:

Ipomoea L. is a member of Convolvulaceae which includes about 500 tropical and warm temperate species [64]. The name of *Ipomoea carnea* Jacq. has been an object of extended discussion [8]. Ten names have been frequently and widely applied synonymously [65]: *Ipomoea carnea* subsp. *fistulosa* (Mart. ex Choisy), *I. batatilla* (Kunth) G. Don, *I. crassicaulis* (Benth.) Robinson, *I. fistulosa* Mart. ex Choisy, *I. fistulosa* var. *nicaraguensis* Donn. Sm., *I. albiflora* Chodat and Hassl, *I. fruticosa* Kuntze, *I. gossypoides* D. Parodi, *I. nicaraguensis* (Donn. Sm.) House, *I. texana* Coult. The names *Argyreiasuperbiens* and *A. splendens* are also referring to *Ipomoea carnea* [38]. "Tararaqui" is the most common vernacular name for *I. carnea* in Bolivia, "Mandiyura" for Paraguay, NE Argentina and Bolivia, "Algodo bravo" for the state Para, Brazil, "Mata cabra" and "Canudo" and "Canudo de

lagoa" for Ceara, Brazil, "Algodao do Pantanal" for MatoGrosso, Brazil and "Capabode" for Parnaiba, Piaui, Brazil, "Manjorana" for Amazonia in Brazil [6]. The English name



Fig. 2. Habitat, habit and flowering of *Ipomoea carnea* recorded at Jazanrgion, KSA.

is the pink morning glory and in Egypt is called "Olleiqek-kibeer" [26].

B. Description:

Ipomoea carnea is a genet individual shrub consists of numerous number of ramets link with each other underground. The following is the description of the plant parts:

1. Stem and root:

The stem is an erect, woody, hairy, more or less cylindrical in shape and greenish in color, monopodially branched, and bearing alternate leaves. It attains 1.5 –3.5 m tall and 0.5 –3.0 cm diameter. The fresh stem is somewhat flexible, but the dry one breaks with a fibrous fracture exposing a whitish green interior, with hollow internodes and solid nodes. The internodes measure 3.5 - 6.0 cm in length [66]. The branches are found mostly at the base of the stem which is short and stout, but firmly rooted in the soil. The plant has a tap root, bearing numerous lateral rootlets. The root measures 50 - 60 cm long and 2.0 - 3.0 cm diameter. Externally, the root is yellowish brown in color, with a rough surface showing longitudinal striation, cylindrical in shape, solid, with flexible fracture when fresh, becoming fibrous when dry [66].

2. Leaf:

The leaf is simple, alternate, exstipulate and petiolate. Petiole is cylindrical, attains 4 - 7.5 cm length and 2.5 - 3.0 mm diameter. The leaf blade is cordate with symmetric base,

measures 13 - 23 cm in length and 5.5 - 9.5 cm in width (Fig. 3), with entire margin and reticulate pinnate venation, slightly hairy on both surfaces, the upper surface is dull green and the lower one is paler. Leaf plasticity related to light and moisture conditions was observed by [3, 6 & 12]. Shaded leaves may grow larger than leaves fully exposed to sunlight. In aquatic conditions differences between sun and shade leaves appeared to be higher than in xeric conditions. In addition to the previous estimations the leaf base showed a great diversity in its shape; sometimes shows symmetrical cordate leaf base and many times shows asymmetrical base with different shapes (Fig. 4).

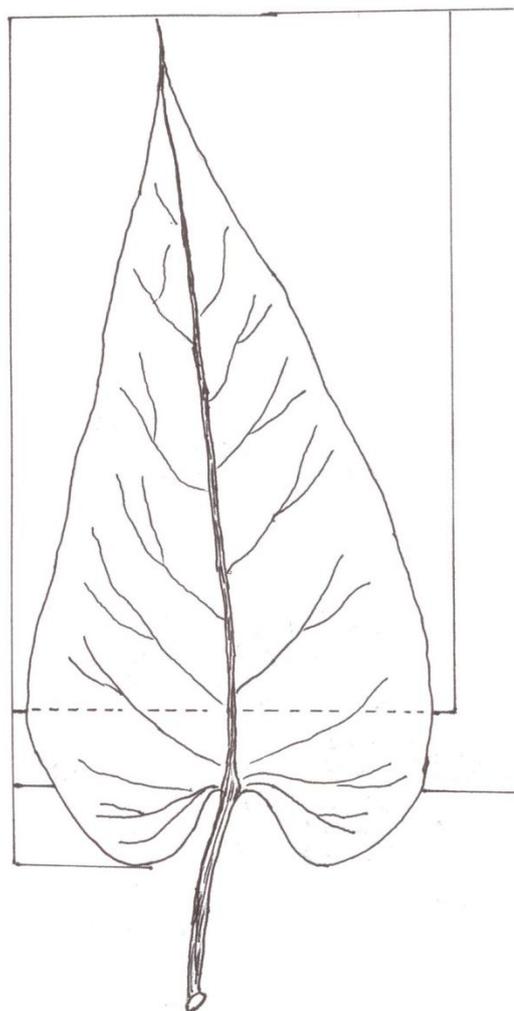


Fig. 3. The leaf of *Ipomoea carnea* Jacq. A = Blade length, B = Width of broadest area, C = Distance between leaf apex and broadest area, D = Midrib length.

3. Flower

The flowers are axial, solitary or arranged in monochasiumscropioidcymose inflorescence. The pedicel is green in color, erect, cylindrical, solitary slightly pubescent, measures 1.5 - 2.2 cm long and 0.15 - 0.20 cm diameter. The calyx is persistent, consisting of 5 free quincunial sepals, ovate in shape, with entire margin, symmetric base and acute apex, green in color, nearly glabrous, measure 0.5 - 0.7 cm long and 0.6 - 0.7 cm width. The corolla is formed of 5 united petals (sympetalous), delicate, pinkish white in color, with 5 pink to violet coloured strands in the regions of cohesion with

each other. The mouth of the corolla has an entire margin, with slight conspicuous depressions at the points of the cohesion of the

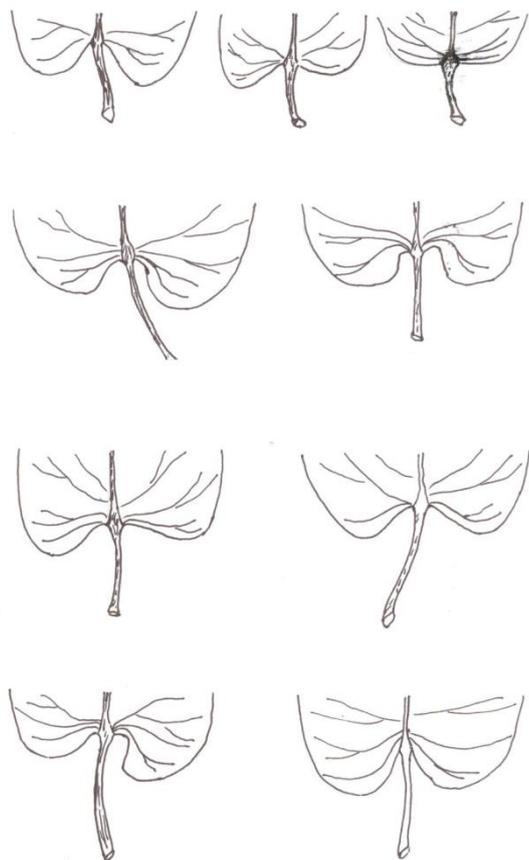


Fig. 4. Different shapes of base of leaf blade of *Ipomoea carnea* leaf.

petals, measure 5.2 - 6.0 cm long and 1.6 - 1.8 cm width at its mouth [67].

The androecium is formed of 5 free epipetalous stamens, which are unequal in length; two of them being longer than the others. They are united to the base of the petals for a distance of 4 mm. The basal part of the filament is hairy, pinkish red in color and swollen, while the upper part is filiform in shape and white in color. The filament measures 1.6 - 2.1 cm long and 0.20 - 0.25 cm width at its swollen base. The anthers are whitish yellow in color, oblong, basifixed and bilobed opened laterally, and contain yellow pollen grains. The anther attains 0.5 - 0.7 cm long and 0.20 - 0.25 cm width. The gynoecium, shows a superior ovary which is bicarpellary, and bilocular. Each locule contains one or two small anatropous basally placented ovules. The ovary is conical in shape, whitish yellow in color, carried on yellowish green hypogenous disc and measured 0.3 - 0.4 cm long and 0.15 - 0.20 cm width. The style is cylindrical, yellowish white in color, measures 1.4 - 1.6 cm long and 1 - 2 mm width and

ending with a bilobed stigma, each attains 0.7 - 1.0 mm long, and 0.3 - 0.6 mm width [67].

4. Fruit and seed:

The fruit is a simple dry dehiscent capsule, which opens septifragally and is derived from a superior gynoecium. It is pedicellate, subglobular in shape, with pointed apex and spherical base, greyish green in color when unripe, turning greyish brown on ripening. The fruit shows five persistent sepals and remains of the style at the apex. It measures 1.0 - 1.5 cm in height, 0.8 - 1.3 cm in width and contains usually four dark brown colored seeds densely covered with hairs. The pericarp is thin, measuring about 0.1 cm thick, smooth and glabrous with yellowish grey inner surface.

The seed measures 0.4 - 0.6 cm in length and 0.2 - 0.3 cm in diameter, dark brown to black in color and derived from an anatropous ovule (Fig. 5). It is covered with an easy removable dense pale brown to greyish brown trichomes, which attain 0.7 - 1.0 cm in length. The seed is three sided, with two flat ventral surfaces that may have a central depression and one convex dorsal surface. The micropyle is represented by a palmar scar near the hilum in the central depression of the ventral surface. The raphe is represented by a raised ridge which extends from the hilum at the base to the chalaza at the apex [68]. The seeds are covered by a dense, cottony, furry indumentum consisting of slightly glossy, and 0.01 - 0.02 mm thick hairs that are slightly swollen at the base. Hairs are much longer on the edge of the rounded abaxial surface of the seeds (at the top and at the base of the elliptically complanate cross section). The seeds have a black, 0.3 mm thick, very hard, bilayered testa.

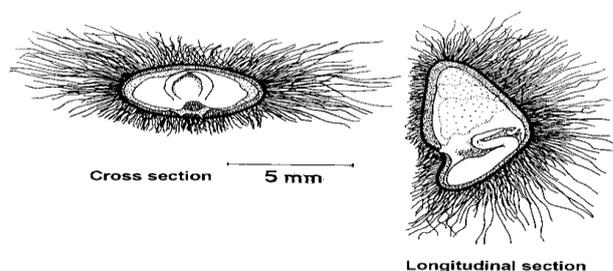


Fig. 5. Cross and longitudinal section of seeds of *Ipomoea carnea* (after [6]).

C. Karyology

karyology of *Ipomoea carnea* indicated chromosome numbers were $n=15$ and $2n=30$ [69, 70, 71 & 72]. The range of chromosome length was 1.69–3.34 μm and the total chromatin length=71.10 μm [73]. Gad El-Karim[74] found that the cytological features of 25 natural populations of *I. carnea* distributed in seven habitat types in the Nile Delta region in Egypt revealed an inter- and intraplant variations in chromosome number ranging from 18 to 60. The karyotype analysis for cells having $2n = 30$ chromosomes representing to the studied habitats revealed a substantial differences in the karyotype structure among the studied accessions. Not only differences were found in the morphology of chromosomes but also in the mean chromosome length of these accessions. The karyotype of *I. carnea* might be inferred from symmetry

to asymmetry as a result of pericentric inversion or unequal translocation. The analysis of seed proteins of *I. carnea* by SDS-PAGE revealed a great variability in protein banding patterns of the accessions under study [75]. This wide inter-population variation observed in accessions from different localities and different habitat types suggests a high genetic diversity among genotypes of this plant. The same author showed a great variation in their genetic structure. Many factors were shown to influence enzyme variation encountered in *I. carnea*, among them reproductive strategy, mating system, life cycle, longevity, mutation, adaptation and selection for environmental changes.

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