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ANDROMONOECY IN *GLOSSONEMA VARIANS* (STOCKS) HOOK.F. (ASCLEPIADACEAE)

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Abstract

Andromonoecy is being reported for the first time in *Glossonema varians* (Stocks) Hook.f. and in the family Asclepiadaceae. Each inflorescence has 2 perfect and 2-6 male flowers. Both type of flowers have similar qualitative characters. However, perfect flowers can easily be recognized due to relatively large size of their component parts, trullate corona lobes, corpusculum partially covered by anther flap, presence of stigmatic chambers, anther wings, normal styles and ovaries and male flowers on the basis of relatively smaller size of their component parts, obtrullate corona lobes, corpusculum not covered by anther flap, rudimentary styles and ovaries, absence of stigmatic chambers and anther wings.

Introduction

The floral structure of the members of Asclepiadaceae exhibit extreme adaptation to insect pollination and has been the subject of much interest since eighteenth century (Sprengel, 1793; Brown, 1883; Delphino, 1865). While studying the Pollen-Ovule ratio of *Glossonema varians* (Ali, 1994), it was observed that certain flowers had unusually small rudimentary ovaries without ovules. After examination of several flowers on many plants, the andromonoecious condition i.e. perfect (hermaphrodite) and male (staminate) flowers on the same plant was confirmed. The present paper describes the phenological and morphological detail of both types of flowers in *Glossonema varians*.

Materials and Methods

Phenological and morphological studies were mainly carried out on fresh material collected from Karachi University Campus and representatives were deposited in Karachi University Herbarium (KUH). Andromonoecy was also confirmed by studying the herbarium specimens from Karachi University Herbarium (KUH), representing different localities of Pakistan.

Result

G. varians is 8-20 cm tall perennial herb, branched from the base with milky latex. Stem is prostrate or ascending, thinly- densely pubescent with white hairs. Leaves are opposite, petiolate, somewhat fleshy, greyish-green, broadly ovate-circular, pubescent with acute, obtuse or mucronate, retuse tip, undulate wavy margin and obtuse to sub-cordate base. Flowers are arranged in subsessile umbellate, 4-8 flowered axillary cymes (Fig. 1A, B). The plant is andromonoecious with two perfect (hermaphrodite) and 2-6

male (staminate) flowers per inflorescence (Fig. $1B_1$).

Perfect flowers: Flowers are actinomorphic and pedicellate. Calyx 5-lobed, lobes green, triangular-subulate, hairy, with acute tips (Fig. 1D). Corolla also 5-lobed, yellow with purplish tinge, campanulate, tube short, lobes oblong-ovate, obtuse-retuse, obtusely keeled at base (Fig. 1E). Androecium consists of five stamens, that are adnate to the stigma head to form the gynostegium (Fig. 1C). Filaments are fused to form the staminal column that surround but not joined with ovaries and styles. Corona is made up of five cream-white, thin lobes, attached to the corolla and surrounding the gynostegium along with the staminal column. Each lobe is trullate, thin, entire, glabrous, smooth alternating with the stigmatic chambers and corolla lobes (Fig. 1F). The five bilocular anthers are united and expanded laterally to form anther head, mostly concealing the lateral surface of stigma head. Staminal column is short. A reniform hyaline anther flap from each anther, partially cover the stigma head laterally (Fig. 1C). Anther margins are bordered by anther wings that are arranged parallel with the wings of adjacent anthers to form five slits or alar fissures over five lateral vertical furrows of the stigma head, thus resulting in the formation of stigmatic chambers (Fig. 1C). At the apex of each slit or alar fissure a black brown corpusculum partially covered by anther flap is present. Each corpusculum is attached laterally to two translator arms. The other end of each translator arm is attached to a pollinium. Thus the corpusculum, translator arms and the two pollinia form a pollinarium (Fig. 1G). Each pollinium is yellow, ovate, without any extra pollinial appendages (Fig. 1G). The pollinium is pendulous in orientation and situated in the basal part of the anther.

Gynoecium consists of two free, superior ovaries and two separate styles, united apically into stigma head. Styles are short and terete. Stigma head is green, fleshy, conical, clavate or peltate, laterally five lobed. Five stigmatic chambers are situated below the lobes of stigma head alternating the anthers. A narrow slit or alar fissure is formed by two anther wings (each from an adjacent anther) over the entire length of each stigmatic chamber, leaving a broad space at the base. Each stigmatic chamber encloses the true receptive stigmatic surfaces of the gynoecium.

Usually solitary follicles are produced per flower. They are usually inflated, 3.0-6.0 (4.2 $\pm$ 0.52) x 1.0-1.5 (1.2 $\pm$ 0.08) cm, ellipsoid, $\pm$ attenuate at apex, echinate. Seeds 5.0-6.0 (5.5 $\pm$ 0.14) x 4.0-5.0 (4.5 $\pm$ 0.14) mm, brown, broadly ovate, flattened and comose.

Male flowers: Flowers are actinomorphic, pedicellate. Calyx and corolla are more or less similar to that of perfect flowers but relatively smaller in size (Fig. 1H-L; Table 1). The corona lobes are obtrullate and bifid (Fig. 1k). The reniform anther flap partially covers the lateral side of stigma head but not the corpusculum. Corpusculum is dark brown and exposed i.e., not covered by anther flap. Translator arms are relatively much elongated and each pollinium is similar to that of perfect flowers (Fig. 1L). Stigma head is relatively large, style and ovaries rudimentary.

G. varians regenerates from the perennating rootstock after rain. Plants usually flower once a year. Flower anthesis starts from the basal inflorescence of a stem and continues towards apex. In an inflorescence first the hermaphrodite flower opens at c. 6.0 - 6.30 a.m. and the next morning (after 24 hours) the second hermaphrodite flower opens. Then the staminate flowers open regularly with an interval of 12 - 24 hours,

Table 1. Floral parameters (range followed by mean and st. deviation) of *Glossonema varians*.

PARAMETERS	FLOWER TYPE		PARAMETERS	FLOWER TYPE	
	PERFECT	MALE		PERFECT	MALE
FLOWER			CORPUSCULUM		
LENGTH	9.0-9.8	8.0-8.6	LENGTH	260-280	240-260
(mm)	9.4 ± 0.15	8.3 ± 0.12	(μm)	269 ± 3.33	250 ± 3.16
			BREADTH	140-155	110-125
PEDICEL			(μm)	147 ± 2.68	117 ± 2.28
LENGTH	3.4-4.0	3.0-3.5			
(mm)	3.6 ± 0.10	3.2 ± 0.09			
BREADTH	1.5-2.0	0.8-1.2	TRANSLATOR ARM		
(mm)	1.7 ± 0.08	1.0 ± 0.06	LENGTH	140-160	295-330
			(μm)	148 ± 3.63	318 ± 5.76
CALYX			BREADTH	45-70	180-210
LENGTH	5.0-5.7	3.8-4.2	(μm)	57 ± 3.85	193 ± 4.82
(mm)	5.2 ± 0.11	4.0 ± 0.43			
BREADTH	1.0-1.5	0.8-1.2	POLLINIUM		
(mm)	1.2 ± 0.08	0.96 ± 0.43	LENGTH	480-520	450-480
			(μm)	502 ± 6.32	460 ± 5.83
COROLLA			BREADTH	270-310	280-310
LENGTH	5.4-6.0	4.8-5.4	(μm)	296 ± 6.32	291 ± 5.37
(mm)	5.6 ± 0.09	5.0 ± 0.13			
BREADTH	2.0-2.2	2.0-2.3	STIGMA HEAD		
(mm)	2.1 ± 0.03	2.1 ± 0.05	LENGTH	1.0-1.4	1.3-1.6
			(μm)	1.36 ± 0.06	1.5 ± 0.05
CORONA	TRULLATE	OBTRULLATE	BREADTH	1.4-1.8	1.6-2.0
SHAPE			(μm)	1.57 ± 0.07	1.75 ± 0.06
LENGTH	3.0-3.4	2.3-2.8			
(mm)	3.1 ± 0.07	2.6 ± 0.08			
BREADTH	1.9-2.4	1.5-2.0			
(mm)	2.1 ± 0.08	1.8 ± 0.09	STYLE	PRESENT	RUDIMENTARY
STAMINAL COLUMN			ANTHER WINGS	PRESENT	ABSENT
LENGTH	1.0-1.5	0.95-1.5			
(mm)	1.3 ± 0.08	1.12 ± 0.09	STIGMATIC CHAMBER	PRESENT	ABSENT
ANTHER FLAP					
LENGTH	650-800	600-715	OVARY	PRESENT	RUDIMENTARY
(μm)	723 ± 22.43	639 ± 20.99			
BREADTH	950-1100	750-950			
(μm)	1033 ± 23.48	853 ± 32.67			

mostly one and rarely two at a time. The flowers remain in bloom for an average of three days (range from 3-4 days) and on the third day of anthesis, the colour of corolla and corona fades and stigma head becomes dark brown. The plant remains in bloom for about 1½ - 2 months. Usually not more than 3-4 fruits are produced per plant. After their dehiscence the leaves and stems dry, wither and only the perennating rootstock remains.

Discussion

In *Glossonema varians*, 2 perfect and 2-6 male flowers are produced per inflorescence. Perfect flowers open earlier (24-48 hrs) than male flowers, similar condition has also been reported by Primack & Llyod (1980) in *Leptospermum scoparium* (Myrtaceae), where both the flowers remain in bloom for about 3 days.

In *G. varians* both perfect and male flowers have similar qualitative characters except corona lobe which is trullate in perfect and obtrullate in male flowers. Relatively perfect flowers as a whole and its parts are larger in size than the male flowers with the exception of translator arms and stigma head which are larger in male flowers (Table 1).

Beare & Perkins (1982) have reported ± dioecious condition in *Asclepias tuberosa* L. According to them, *A. tuberosa* L., could be divided into Fruiting (Female) and Non-Fruiting (Male) plants. Fruiting plants have wider alar fissures than their pollinia widths while Non-Fruiting plants have narrow alar fissures than their pollinia widths, thus functioning as pollen recipients and pollen donors, respectively. Although, both type of plants have bisexual (perfect) flowers. In contrast to *A. tuberosa*, Morse & Fritz (1985) reported that *A. syriaca* L. could not be separated into donor and recipient clones.

Andromonoecy in *G. varians* seem to be the first report of sexual differentiation of Asclepiads flowers into morphologically and functionally distinct perfect (bisexual) and male flowers.

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