FLORAL ABNORMALITIES IN CASSIA GLAUCA LAM

WAHID HASAN

Jamia Science College, Malir, Karachi

(Received November 25, 1961)

Abnormalities in the flowers of *Leguminosae* are not uncommon. A large number of abnormalities have been reported from time to time. [Krishna Murthy (1959), Chakraverti (1952), Biswas (1954), Pillai (1955), Singh and Mehta (1955). The present observations consist of abnormalities not hitherto recorded in *Cassia glauca Lam.*

Seven hundred flowers from 6 plants of 3 to 6 years of age growing at a height of 50 to 55 ft. above sea level in the sandy loam soil, were collected and examined; 408 flowers were found to be abnormal i.e. 58.25% Normal flowers conform to the formula K 5 C 5 A 10 G.[1]

The abnormalities observed in the flowers are given below and have been summarized in Table 1.

(A). CALYX

In 10 flowers one sepal of each flower is quite similar to petal in size, colour and venation. Its sepaloid nature is confirmed by numerical analysis and relative positions to the petal in aestivation. (Fig. 1).

(B). COROLLA

1. *Stripped Shaped Structure.*—A stripped shaped structure is found with the petal along mid-longitudnal line (Fig 2 A, B). Transverse section of petal with stripped shaped structure shows two immature pollen sac-like structures attached on either side of mid-longitudnal line (Figs. 12 and 13). Such structure can either be staminode petals or petaloid stamens.

The numerical analysis of components of corolla whorl is indicative of its petaloid nature. The evidence obtained from the study of the vascular anatomy of the structure concerned is in favour of the transformation of petal into stamen -like structure (Fig. 3A) and does not support the view of the fusion of stamen with petal.

2. *Antheriferous Petal.*—Another lobe on one side of the petal has been seen on the above-mentioned flowers (Fig. 3 A, B). In transverse section, normal type of pollen grains have been found in pollensac of such structures. This type of structure is interpreted as an antheriferous petal in view of its positions. That this is not a petaliferous stamen is confirmed by numerical analysis of the Whorl. Transverse section of this structure shows an antherlobe and petal with normal pollen grains (Fig. 11), and the transverse section of stalk shows single vascular supply. (Fig. 14 A).

(C). ANDROECIUM

1. *Petaliferous Stamen.*—Various degrees of abnormalities have been observed in stamens. A small portion of petal is found on one side of antherlobe (Fig. 4) and in other stamens half or a part of antherlobe has been found completely changed into petal. In transverse section, stalk of petaliferous stamen shows single vascular bundle (Fig. 14 B).

2. *Fusion of Two Stamens with Each Other.*—8.87 % flowers show the fusion of two stamens throughout their stalks and some times with their anthers (Fig. 5, 10).

3. *Staminode.*—5% of the total flowers show stamens changed into staminode. Here anthers are completely absent; only the stalks are present in place of stamens.

4. *Variable Number of Stamen.*—12.42% flowers have been observed having 7, 8 or 9 instead of 10.

5. *Stamen Fused with Petal.*—In 18 flowers out of 700, stamen is found fused with petal through stalk. (This fact is further supported by the presence of two vascular bundles in its stalk Fig. 3 C, D).

6. *Pistil Fused with Staminode and Stamen.*—Stamen and staminode are fused with pistil in 91 flowers out of 700. 1.5% of the total flowers show the fusion of pistil and staminode, but in 11.5% of the total flowers the fusion is in between stamen and pistil (Figs. 6, 7, 8 and 9).

Fusion between the stamen and pistil is confirmed by the presence of two vascular bundles, seen in the transverse section of their common stalk (Figs. 3 C. D).

Discussion

De Candolle was the first to have stressed the importance of vegetable teratology. Since then a large number of abnormal cases have been reported from time to time for which different

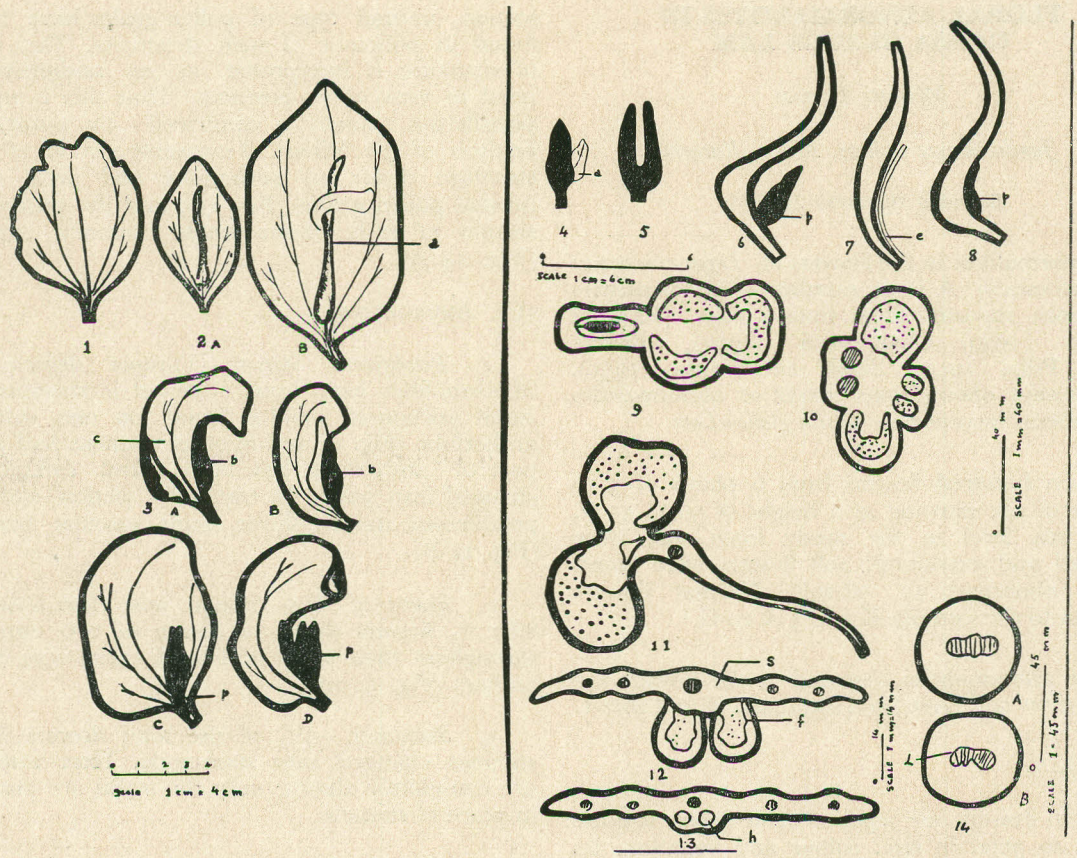

Fig. 1.—Petal like sepal; Fig. 2.—A, B. striped shaped structure in petal; Fig. 3.—AB Antheriferous petal; Fig. 3.—C, D.—Stamen fused with petal; Fig. 4.—Petaliferous stamen; Fig. 5.—Stamen fused with stamen; Fig. 6 & 8.—Pistil fused with stamen; Fig. 7.—Pistil fused with staminode; Fig. 9.—Transverse section of antheriferous petal; Fig. 10.—Transverse section of fused stamens; Fig. 11.—Transverse section of Antheriferous petal; Fig. 12 & 13.—Transverse section of striped shaped structure in petal; Fig. 14A.—Transverse section of stalk of antheriferous petal and Fig. 14 B.—Transverse section of petaliferous stamen.

a, X stripped shaped structure; b, Antherlobe; p, stamen; d, petal;
e, staminode; f, h, pollensac-like structure; i, vascular bundle.

TABLE 1

S. No.	Abnormalities	No. of flowers	%
1.	Petal shaped sepals	8	1.1
2.	Striped shaped structure	10	1.42
3.	Antheriferous petals	34	4.87
4.	Petaliferous stamens	52	7.42
5.	Fusion of stamen and stamen	62	8.87
6.	Staminodes	35	5
7.	Variable number of stamens	87	12.42
8.	Pistil fused with stamens	81	11.5
9.	Pistil fused with staminode	11	1.5
10.	Stamen fused with petal	18	25.57
	Total number of abnormal flowers ..	408	8.25
	Total number of normal flowers ..	292	41.75

reasons have been attributed. Recently Haslop Harrison (1952) has reconsidered the problem in a useful way. Some of the chemicals are well-known for inducing abnormalities but it has also been found that some of the abnormalities have a genetic basis, as has been pointed out by Krishna Murthy (1959).

In the present case the percentage of abnormalities is quite high as 58.25% of flowers were found to be abnormal. So it should not be treated as an isolated case of teratology, but there are reasons to believe that it has some genetic basis.

All the cases of transformation of sepals into petals and of petals into stamens seem to strengthen the view that these structures should be looked upon as appendicular in nature (Gothe and De Candolle 1831) and the opinion of Wilson (1939) that stamens and petals are derived from primitive branch system does not seem to be substantiated by these observations. In *Cassia glauca* Lam, 10 fertile stamens are present. But the reduction of some of the stamens into staminode or the absence of some of the stamens observed here, may be looked upon as reflecting upon the tendency of the reduction in the number of stamens which seems to have finally been established in some other species of *Cassia* e.g., *Cassia occidentalis* Linn, and *Cassia fistula* Linn.

Normally no fusion between the different stamens is observed. The fusion of stamens with one another as observed here seems to be indicative of mono-adlphous or di-adlphous condition which has finally been established in some other genera of *Caesalpiniodeae* also e.g., *Sindora* and *Amherstia*. It is rather difficult to give any such explanation for the fusion of stamens with petal and pistil.

In view of high percentage of abnormal flowers in the present population, the abnormalities discussed above have probably originated as a result of disturbed genetic balance the causes of which remain to be ascertained.

Acknowledgement.—The author is thankful to Dr. S. I. Ali, Department of Botany, University of Karachi for his valuable guidance, and to Mr. S. M. Shafi, Principal and Mr. Qazi Mazharul Haq, Head of the Department of Botany, Jamia Science College, Karachi, for their interest in the work.

References

1. K. C. Biswas, Sci. and Culture, **19**, 557-559 (1954).
2. D. N. Chakravarti, Sci. and Culture, **18**, 292-293 (1952).
3. Mohammad Farooq, Sci. and Culture, **18**, 192-193 (1952).
4. S. M. H. Jafri and S. I. Ali, Scientist (Pakistan), **2**, (3 & 4), (1957).
5. K.V. Krishna Murthy and N. R. Bhat, J. Indian Botan. Soc., **38**, 59 (1959).
6. S. K. Pillai, Sci. and Culture, **24**, 164-165 (1955).
7. S. P. Singh and T. R. Mehta, Sci. and Culture, **22**. 169-170 (1955).
8. C. L. Wilson and T. Just, Botan, Rev., **5** 97-131 (1939).

DETERMINATION OF ALKALOIDS BY RESIDUAL NON-AQUEOUS TITRATION

G. A. MIANA AND M. IKRAM

Indigenous Drugs Research Division, North Regional Laboratories, Pakistan Council of Scientific and Industrial Research, Peshawar.

(Received March 20, 1962)

Non-aqueous methods using perchloric acid as a titrant have found wide acceptance in the analysis of amines and amine salts[1-7] which constitute a very high percentage of medicinal agents in use to-day. Various indicators have been used in these titrations but potentiometric titrations are necessary to establish the equivalence point, specially in highly coloured media.

Wang and Hunter[6] recently described a method for determining alkaloids by means of a cation-exchange resin. The resin removed the cation, while the organic base was determined by direct titration with standard perchloric acid. Spengler and Kaelin[2] observed that the presence of water in the solvent gives erroneous results and that water could be easily removed by heating the mixture with excess perchloric acid.

The present investigation deals with the residual non-aqueous method for the estimation of certain alkaloids.

Experimental

Apparatus.—A glass electrode as indicator electrode and a saturated calomel electrode as reference electrode and a direct reading pH meter was used. The two electrodes were connected in series with a variable resistance.

Preparation of Reagents

0.1N *Acetous Perchloric Acid.*—This was prepared by adding 10.5 ml. of 60% perchloric acid to about 500 ml. of glacial acetic acid. Acetic anhydride (25 ml.) was then added and the volume made upto 1 l. with glacial acetic acid. The solution was allowed to stand overnight, and then was standardized with (0.1N) potassium acid phthalate.

To prepare the standard potassium acid phthalate solution, 0.2040 g. of the phthalate was accurately weighed and dissolved in 100 ml. of glacial acetic acid by warming. The titration was carried out potentiometrically and the normality calculated on the average of three determinations.

0.1N *Sodium Acetate.*—This was prepared by dissolving 8.2 g. of anhydrous sodium acetate in 1 l. of glacial acetic acid. The solution was standardized against standard perchloric acid both by visual indicators and by potentiometry.

Indicators.—α—Naphtholbenzin, 0.5% w./v. in glacial acetic acid, and crystal violet, 0.5% w./v. in glacial acetic acid.

Procedure

About 20.0 to 30.0 mg. of the alkaloid was accurately weighed and dissolved in exactly 5-10 ml. of standard perchloric acid. The excess acid was back-titrated with standard sodium acetate by visual indicators and by potentiometry. The assay results (average of three titrations) are given in the Table 1.

Acknowledgement.—We are thankful to Dr. S. A. Warsi, Director of the North Regional Laboratories, Peshawar for his keen interest and encouragement in the present work.

TABLE 1.—ASSAY OF ALKALOIDS IN GLACIAL ACETIC ACID.

	Alkaloids	Amount added (mg.)	Amount found (mg.)
i	Atropine ..	26.50	26.52
ii	Atropine sulphate	21.25	21.20
iii	Papaverine ..	48.78	48.78
iv	Nicotinamide ..	21.90	21.50
v	Nicotin hydrogen tartarate ..	23.56	23.48
vi	Serpentine ..	32.52	32.48
vii	Ajmaline ..	22.80	22.90
viii	Ajmalicine ..	23.0	22.80
ix	Colchicine ..	26.62	26.61

The bases vi, vii and viii were vacuum dried at 100°C.

References

1. R. L. Herd, J. Am, Pharm. Assoc., Sci. Ed., **31**, 9 (1942).
2. H. Spengler and A. Kaelin, Pharm. Acta Helv., **18**, 542-64 (1943).
3. S. Przyszlakowski, Acta Polon Pharm., **17**, 395-398 (1960).
4. P. Ramchandra Naidu and V. R. Krishnan, Anal. Chem., **33**, 497-498 (1961).
5. H. Feltkamp Deut. Apotheker Ztg., **101**, 207-210, (1961).
6. S. M. Wang and R. W. Hunter, J. Pharm. Sci., **50**, (1961).
7. P. Kerney, J. P. Billan and F. Bigeard, Ann. Pharm. Franc., **18**, 901-61, (1961).
8. A. H. Beckett and E. H. Tinley, *Titration in Non-aqueous Solvents* (The British Drug Houses Ltd.), p. 19.