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processes of the mature maggot are dimly visible. The maggots soon after hatching feed on the Aphids by sucking out their body contents and begin to grow in size. They moult twice before pupation. In the mature maggots (Fig. 3) the pale white colour changes to that of yellow and the anal 'horns' are longer* and more prominent, their tips being black. A detailed examination of the 'horns' under the microscope reveals the prolongation of the lateral tracheal tubes into the horn like processes which end in three-branched claw-like structures. The full grown maggots are about 2·5 m. m. long. Before pupation the maggots exude a cement-like white fluid, probably for attachment, which hardens and turns black in colour in a couple of hours. The larval period lasts four to five days.

Pupæ. The pupae (Fig. 4) are dark brown in colour and look similar to the mature maggots but are more stumpy. These are about 2·2 m. m. long and 1 m. m. broad. In five to seven days the adults emerage by pushing their way out at the anterior end of the pupae.

Adults. Adult flies (Fig. 5) are very active creatures, short and stout and measure about 2 m. m. long. The general colour of the fly is greyish dark. Antennae including arista are dark and the halteres pale yellow. The abdomen is grey with a round black spot on each side of the median line of the second tergite. Legs are light dark. Adult flies have been noted feeding on the honey dew of Aphids A fly fed with jaggery water in captivity lived 21 days. The total life cycle lasts 11 to 16 days.

Hosts. Fly maggots have been observed feeding on Aphids on a variety of plants such as Cholam (*Sorghum*), Cotton (*Gossypium*), Cumbu (*Pennisetum typhoideum*) and beans (*Dolychos lab-lab*).

Parasites. A few *Chalcids* were once collected from a Leucopis pupa but in nature the number of such parasites seems to be very few.

GRAM WEIGHT IN RELATION TO POD AND SHOOT WEIGHTS IN BENGAL GRAM

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Introduction. In preliminary yield trials of crops the plant breeder has often to handle a large number of types although only a few of these can be carried forward. It is a practical consideration that the methods adopted at such a stage allow examination of as wide a range of material as possible with the minimum of labour and without loss of efficiency. Each crop sets its own problem in this connection.

* Since sending to the press a few maggots with shorter respiratory horns, probably another species of *Leucopis*, have been collected feeding on Aphids and are under study.

In Bengal gram (*Cicer arietinum*) for instance, the actual determination of the yield requires the stripping and threshing of the pods and will take time and labour when the number of plants is large. Any method which will do away with much of this labour will be an improvement. Towards this end, other more easily determinable characters indicative of yield were investigated. The results of such a study are presented in this paper, from work done at the Nandyal Agricultural Research Station during the year 1932–33.

Material and methods. The material of the enquiry comprised 399 different cultures of Bengal gram grown along with 201 lines of local bulk in lines 1½ feet apart in the usual arrangement of raw yields, with a control line of local bulk coming between every two selections. Plants were spaced 9 inches apart in the lines each of which allowed for 26 plants excluding out-skirts. Each line of controls, as well as the selections was harvested separately and examined for the following characters.

(1) Shoot weight, (2) Pod weight and (3) Gram weight (weight of all plants correct to ¼ oz.) The shoot weight was the portion harvested by the sickle free of the roots.

Relations of the characters. For purposes of this study the gram weight was taken as the ultimate basis of yield, and, the extent to which the other two characters could be relied on as a measure of it was investigated. The co-efficients of correlation expressing the relations between the characters are given below :—

Table I.

Correlation of characters, pod weight, shoot weight and gram weight in Bengal gram.

Pairs of characters.	Local bulks (201)		Selections (399)	
	Correlation coefficient.	Partial correlation coefficient.	Correlation coefficient.	Partial correlation coeffieient.
1	2	3	4	5
Grain weight and Shoot weight	0·938±0·006	0·444±0·037	0·926±0·005	0·387±0·029
Grain weight and pod weight	0·972±0 003	0·792±0·017	0·982±0·001	0·885±0·007
Shoot weight and pod weight	0·924±0·007	0·147±0·045	0·912±0·006	0·042±0·033

It is apparent that the characters form a very closely related group, the coefficient of correlation exceeding 0·9 in all cases. As the relationship is very high, it will be useful to evaluate the contributions of each character after eliminating the effects of the others. The partial correlation coefficients got in this way are given in columns (3) and (5). It is seen from these values that the greater part of the

relation is due to that of gram weight and pod weight, and to a less extent to gram weight and shoot weight. In order to understand more fully the significance of these relationships it will be necessary to know in what manner they are expressible.

The regression of the other characters on the gram weight:— If the characters, shoot weight and pod weight are sufficiently indicative of the gram weight, two conditions must be fulfilled. The first is that the relationship should be simple and definite ; secondly a large proportion of the variation in gram weight should be expressible by them. In order to determine these two points the variance in gram weight due to the other two characters was analysed into the several components. (Fisher R. A. Statistical methods 1932 P. 231). The results are given in table II.

Table II.

Relation of Gram Weight to other characters.

ANALYSIS OF VARIANCE.

Relative	Control Bulks						Selections.					
	Shoot Weight			Pod Weight			Shoot Weight			Pod Weight		
	Freedom	Sum of Squares	%	Freedom	Sum of Squares	%	Freedom	Sum of Squares	%	Freedom	Sum of Squares	%
Variance in gram weight due to:-												
Linear regression.	1	1587·1	88·5	1	1715·1	95·7	1	5065·7	85·9	1	5666·5	96·1
Diviation from linear regression.	28	93·1	5·5	19	9·1	0·5	42	96·9	1·6	27	137·7	2·3
Within arrays.	171	107·5	6·0	180	68·5	3·8	355	735·6	12·5	370	93·0	1·6
Total.	200	1792·7	100	200	1792·7	100	398	5897·2	100	398	5897·2	100
Significance of departure from straight line.	Significant P<·01			Not significant.			Not significant.			Significant P<·01		

It is seen that from 86 to 96% of the variation in gram weight is accounted for by the simple relation of a straight line with the other characters. Even though the departure from linear regression is significant in two cases, the percentage attributable to this cause is low, (less than 5·5%). It can therefore be concluded that the gram weight of any selection or plant is expressible to a very large extent directly from the shoot weight or pod weight. The equations giving the relations of the characters are given below all weights being in ounces:—

	In Bulks.	*In Selections.*
Gram weight = 0·4760	shoot weight plus 0·060.	0.4594 shoot weight plus 0·264.
= 0·7329	pod weight plus 0·015.	0·7215 pod weight ,, 0·145.
Gram weight = 0·139	shoot weight plus 0·540 pod weight—0·070.	0·091 shoot weight plus 0·601. pod weight ,, 0·060.
	(R = 0·9777).	(R = 9·0845).

The very high values of the multiple correlation coefficient 'R' indicate that a remarkable accuracy (about 95%) in gram weight is got by the combined characters.

The real advantage of the relations however lies in their applicability. From practical consideration even the determination of pod weight appears unnecessary. The labour of stripping the pods can be avoided and the preliminary selection made on the basis of shoot weight only with a fair degree of accuracy (nearly 90 %). If, for example, we require to choose plants or selections with 20 % increase over control in gram weight, the error involved by choosing those with 20 % and over increase in shoot weight will be negligible, the only condition necessary being that the harvest of the plants should be done when they are in a thoroughly and uniformly dry condition as in plants of the present study.

Summary. The pod weight, shoot weight and gram weight form a very closely related group of characters the coefficient of correlation exceeding 0·9 in all cases. When the effects of the different characters are independently evaluated the relation of gram weight and pod weight is most pronounced ($r_{pg\,s.} = 0{\cdot}8$), while that of gram weight and shoot weight is next in importance ($r_{gs.p.} = 0{\cdot}4$).

The gram weight can be expressed directly as a simple function of either pod weight or shoot weight. The equations expressing these relationships are similar in bulks as well as selections and give an accuracy ranging from 86 to 95 %.

For purposes of preliminary yield trials it is not even necessary to determine pod weight. Selections made on the basis of shoot weight will hold good for gram weight without any appreciable loss of accuracy