

NOT FOR ISSUE

# A COMPARATIVE STUDY OF REPRODUCTIVE STRATEGIES OF TWO COMMON WEEDS OF MEGHALAYA

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ABSTRACT

THESIS SUBMITTED IN FULFILMENT OF THE DEGREE OF  
DOCTOR OF PHILOSOPHY IN BOTANY



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SHILLONG, INDIA

SEPTEMBER, 1981

Studies on the 'reproductive strategies' of weeds form an important aspect of the understanding of their biological equipment. A thorough knowledge of this important aspect could go a long way in devising efficient weed-control measures. The present work deals with the reproductive strategies of two common weeds of Meghalaya, Spergula arvensis L. and Plantago major L.

S. arvensis is a weed of the croplands and is commonly found associated with maize and potato. It is characterized by rapid growth and completes three life cycles in a single year. On the other hand, P. major is a weed of wastelands and lawns. It was considered worthwhile to investigate the reproductive strategies of these two weeds of contrasting habitats and relate the findings to the occurrence, survival and spread of these two weeds in nature. Reproductive allocation has been considered to be a useful parameter for studies on reproductive strategies of plants. Whereas some reports indicate that reproductive allocation is genetically determined and species-specific, others have shown that resource allocation with special reference to reproduction is a plastic trait and plants respond differently to different environmental conditions. The present thesis embodies the results pertaining to the responses of the two weeds, with special reference to reproductive allocation and reproductive effort to varied ecological conditions. The observations were taken under both field conditions and pot-culture experiments, with regard to the effect of (i) Associates and population

density in nature, (ii) Soil texture and moisture, (iii) Soil nitrogen and density and (iv) Soil nitrogen and light. Besides these, the reproductive strategy of the three populations of S. arvensis growing during different times of the year was also studied. A brief account of the results of various aspects taken up for study in the present thesis is as follows:

i) Effect of associates and population density in field conditions:

The field populations of S. arvensis and P. major representing three density levels - low, medium and high were sampled for studying the effect of density on yield and reproductive allocation of the two weeds. It was observed that in both the species, yield decreased with increasing density. The allocation of dry matter was, however, different, with S. arvensis allocating more resources towards reproductive purposes under the densely crowded situation, while in P. major the reproductive allocation was not affected by crowding. The crude reproductive effort (CRE) and seed number per gram biomass were also higher under higher levels of crowding in S. arvensis, while in P. major the CRE and seed production were negatively correlated to population density.

In both weeds, yield was reduced in the presence of associates. The effect of associates with special reference to the time of emergence of S. arvensis in presence of maize was also investigated. S. arvensis grown in pots with already

established maize plants, showed an increase in CRE and number of seeds per gram biomass. In the presence of potato too, increase in reproductive allocation was observed in this weed. P. major, on the other hand, showed a decrease in reproductive allocation when grown with the associates and this highlights a basic difference in the strategies adopted by the two weeds. S. arvensis responds to the 'stressed' condition by increasing its reproductive allocation. P. major, on the other hand, places greater emphasis on vegetative development which may be considered a strategy for efficient utilization of the available resources.

ii) Effect of soil texture and moisture:

The reproductive strategies of the two weeds, were studied in relation to soil texture and moisture regime in pot culture experiment. S. arvensis grew better on sandy soil with daily watering, while P. major showed no such preference. In P. major, seed production was increased with increased moisture stress in both garden and sandy soil. Conversely, S. arvensis showed a decrease in seed number with increasing moisture stress in both soil types. The reproductive effort of S. arvensis was much larger (26.2-63.1%) than P. major (2.3-9.2%). There was greater emphasis on reproduction by S. arvensis under both soil types and various moisture regimes while P. major was characterized by higher allocation to vegetative structures which may confer a competitive advantage by increasing its efficiency of resource capture. Thus, S. arvensis seems to be 'r- selected'

and P. major, 'K- selected'.

iii) Effect of soil nitrogen and density levels:

The growth and reproductive strategies of the two weeds, were studied in relation to two soil nitrogen and four population density levels. The dry matter yield under the various treatments revealed that S. arvensis is less sensitive to density increase than P. major. The dry matter allocation pattern with reference to reproductive allocation was, however, not appreciably modified due to soil nitrogen or density levels in both the species, though reproductive allocation was higher in S. arvensis than P. major. S. arvensis produced larger number of seeds in nitrogen rich soil while this was not true in case of P. major.

iv) Effect of soil nitrogen and light conditions:

S. arvensis and P. major were grown under two soil nitrogen and two light conditions. Although the growth of both the weeds suffered in shade, S. arvensis was affected more adversely. The 'crude reproductive effort' of S. arvensis was reduced from 19.3% under high soil nitrogen and light regimes to 2.8% under the low regimes while in P. major the reduction was not so drastic (from 9.3% to 4.0%). The change in allocation for reproductive purposes with soil nitrogen and light implies that the two weeds are capable of developing different strategies depending on environmental conditions. The results highlight as to why S. arvensis is restricted only to crop-fields

and P. major is successful on wide range of habitat conditions.

v) Reproductive strategies in the three populations of S. arvensis:

Field observations revealed that S. arvensis is capable of completing three life cycles in a single year, which have been differentiated as Spring (February to May), Summer (June to August) and Autumn (September to November) populations. Investigation revealed that density affects the yield so much that even the variations in yield of the three populations are masked by density effects. The period from February to May proved to be the least conducive for reproductive allocation in all the three populations, while in the later months reproductive allocation was more. Seed production, CRE, and number of seeds produced per gram biomass also showed similar trend. These results have been discussed in context of the conditions prevailing in nature. Thus the capability of completing three life cycles in a year can be viewed as a strategy whereby seed production continues throughout the year to combat the risks associated with environments which are only intermittently favourable for growth.

The results obtained during the course of this investigation show that in S. arvensis reproductive allocation is positively correlated with crowding and soil nitrogen. This may be considered a useful strategy for a crop-land weed which has to encounter these situations in nature. Besides, the completion of as many as three life cycles in a year by Spergula may be

considered another strategy to offset the risk it has to face in a habitat that is highly disturbed and where it faces constant threat of removal by weeding and other agricultural practices. The significance of the completion of three life cycles lies in production of sufficient seed to ensure continued survival. P. major on the other hand which is a ruderal, does not show the differential responses as exhibited by S. arvensis and occurs over a wide range of ecological habitats. Viewing the behaviour of the two weeds from the view point of 'r' and 'K' selection, S. arvensis with its higher reproductive effort and short life cycle may be considered more towards 'r'- and P. major with its lesser reproductive effort and emphasis on development of vegetative organs for efficient utilization of both above and below-ground resources may be assigned a position more towards 'K'. These very characters can be considered to assign Spergula a position towards 'R'- and Plantago towards 'C'- in the 'C-S-R-' strategy model of Grime where 'S' and 'R' correspond to the extremes of 'r-' and 'K-' respectively and 'C' occupies an intermediate position, signifying high competitive ability of the individuals. Thus the present work highlights the reproductive responses of the two weeds to various imposed treatments and the data collected may be useful in devising weed-management programmes.