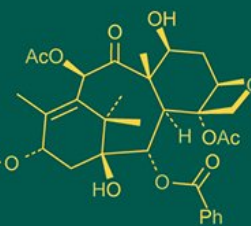
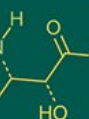
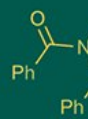


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Crucial Need to Control *Orobanche ramosa* infestations for protecting Rapeseed and Mustard production in Karbi Anglong District, Assam

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Abstract

In Karbi Anglong and West Karbi Anglong districts of Assam the tribal people are practising traditional agriculture i.e. jhum or shifting cultivation in the hilly areas while in the plains mono-cropping is mainly practised by the farmers. Rapeseed is a major rabi crop which are cultivated by the farmers in the plain areas as a mono crop. Report on the occurrence of *Orobanche* in rapeseed areas has been reported. But due to lack of proper data and information the degree of its infestation is not known. Therefore, a survey and data collection was conducted to find out the intensity and degree of *Orobanche* infestation in rapeseed and mustard fields. Results showed that the intensity of *Orobanche* infestation was very high in rapeseed field while in mustard field the infestation was almost nil. *Orobanche ramosa* L. is an obligate root parasite which causes considerable yield losses on several major crops as it get attaches to the roots of the nearby host plants and once attached to a host, the broomrape sucks all the water and nutrients from its host plant. As a result of which the yield of rapeseed production was reduced by 20-30 per cent in the surveyed areas.

Keywords: *Orobanche* infestation, production and yield, intensity, Patradisa and Arnam Teplong.

Introduction

Orobanche ramosa L an obligate root parasite belongs to Orobanchaceae family also commonly known as branched broomrape. The *Orobanche* plants grow in clusters above the ground, reaching heights of only 10-60 centimetres, depending on the species. These plants produces leafless flowering stem and the upper two-thirds of the stem bears sparse inflorescence. Each flower produces a small capsule containing 40,000 to 50,000 or even more tiny seeds (0.15-0.5 mm long), which can remain viable in the soil for up to 20 years. Since they lack chlorophyll, broomrapes rely entirely on other plants for nutrients. Broomrape seedlings extend a root-like growth that attaches to the roots of nearby host plants. Once attached, the broomrape extracts all the water and nutrients it needs from its host. Parasitic weeds, such as *orobanche*, are highly destructive and hinder the growth of host plants, affecting production and productivity. They are particularly difficult to control. Manual removal is effective but labour-intensive and costly. The use of appropriate chemicals, agronomic control methods, and host-resistant crops is another method, but further research is needed to determine the most suitable techniques. Biological and host crop resistance approaches are promising but expensive and may not provide complete control. Integrated approaches combining several techniques could be more effective, but they are currently limited due to high costs and technical challenges (Jat and Singh, 2018) [4]. Effective control measures need to be targeted in the most severely infested areas, while maintaining the seed bank of less infested areas below a threshold level of damage. *Orobanche's* control is exceptionally difficult due to its underground location, lack of photosynthesis, late appearance of parasitic shoots, closer association with host plant roots, and complex seed dispersal, germination, and longevity mechanisms. Several attempts have been made to control this parasite through the use of herbicides, synthetic germination, stimulation, crop rotation, nitrogenous fertilizers and soil solarisation (Qasem and Kasrawi, 1995) [13]. However, integrated management approach is always better to manage *Orobanche*

in field crops (Das *et.al.*2023) ^[15]. Therefore, understanding the factors behind Orobanche germination and the soil's actual seed load is crucial for identifying and developing management strategies to deplete the soil seed bank of Orobanche. The Hill Zone of Assam comprising Karbi Anglong, West Karbi Anglong and Dima Hasao Districts where major population consists of Tribal like Karbis and Dimasas. The climate of Karbi Anglong is generally dry and warm with a temperature ranging from 6°C- 12°C in winter and 23°C -35 °C in summer. The average rainfall is very low as compared to other districts and the annual rainfall varies between 1206mm - 2416 mm. In Karbi Anglong and West Karbi Anglong districts the Karbis are practising traditional agriculture i.e. *jhum* or shifting cultivation growing more than two crops at a time as mixed cropping while in the plains mono-cropping is practised by a majority of the population. The major crops grown in the plain areas are rice, maize, wheat, rapeseed and mustard, potato, summer and winter vegetables. Orobanche infestation in rapeseed areas has been reported in Karbi Anglong district but due to lack of accurate data and information, the degree of its infestation is not known. Therefore, the present investigation was undertaken to find out the degree of infestation of Orobanche in rapeseed and mustard crops and the extent of reduction in the yield of these two crops due to its infestation.

Methodology

A survey was conducted during 2023-24 in major rapeseed and mustard producing areas of Karbi Anglong and West Karbi Anglong District for the orobanche infestation in the crops. In Karbi Anglong District three Development Blocks viz. Langsomepi, Samelangso and Bokajan were selected purposively as rapeseed and mustard are widely cultivated in these areas. In West Karbi Anglong two Development Blocks viz Socheng and Rongkhang Block were selected for the survey. From each Block three villages were selected randomly from the list of villages prepared in consultation with the respective Block Agricultural Development Officer (ADO's) where rapeseed and mustard are largely cultivated. From the survey it was found that orobanche infestation in rapeseed field occurred only in Patradisa village, Langsomepi Block of Karbi Anglong District while in West Karbi Anglong District orobanche infestation was found in Arnarn Teplong village under Rongkhang Block. Therefore, the data was collected from these two villages. The survey and data collection for orobanche infestation in Patradisa and Arnarn Teplong was conducted at the harvesting stage before harvesting the crop. The crop cutting survey was carried out in different plots of rapeseed and mustard which was selected randomly. Altogether 20 (twenty) number of plots were selected randomly with an area of 1m² (one) and the number of count of orobanche in each plot was recorded. The average number of occurrence of orobanche was estimated and then converted to the number of infestation per hectare. A Participatory Rural Appraisal and Focus Group Discussion approach was carried out in both the villages to extract the information on the occurrence of orobanche and type of varieties of rapeseed and mustard grown by the farmers. The yield data of HYV (TS-38) and Local variety of rapeseed variety and mustard HYV (PM-28) was collected at the time of harvest by randomly selecting 5 (five) numbers of plots with an area of 5m² each and a crop cutting was carried out and threshing was also

done on the spot. The fresh weight was then recorded for each plot and the average weight was finally estimated. The sample was then dried in the sun for a few days and the final weight was again recorded to obtain the average final weight and converted into Kilograms per hectare.

Results and Discussions

From the interaction with the farmers of these two village it is revealed that orobanche infestation in both the areas occurred for the first time in rapeseed fields. The farmers also cited that two years back the field was subjected to flood and the whole area was inundated. In Arnarn Teplong area it was also found that one part of the area under rapeseed where sugarcane cultivation was carried out five years back the area was not infested with Orobanche. From the data collected in the rapeseed and mustard plots at Patradisa and Arnarn Teplong it was found that the average intensity of infestation of Orobanche was much more in Patradisa (72.18 nos./m²) than that in Arnarn Teplong (35.09 nos./m²) in the rapeseed field. Similar results was observed in the field farmers' local Varieties at 73.26 nos./m² in Patradisa and 35.57 nos./m² in Arnarn Teplong area. Contrastingly, it was observed that in Patradisa and Arnarn Teplong mustard plots the infestation of Orobanche was nil in Arnarn Teplong but in Patradisa only one or two of Orobanche was observed in one bigha (1333.3m²) plot of land (Table 1). The reason for zero infestation of Orobanche in mustard plot might be due to the high pungency of the crop or might be due the present of glucosinolates in mustard which are important precursors in mustard species, responsible for their flavour and odour development (Augustine & Bisht, 2015; Liu *et al.*, 2009) ^[1, 10]. But further research is needed to confirm the reason behind such contrast differences of Orobanche infestation between mustard and rapeseed crops. The Orobanche infestation and average yield of rapeseed and mustard is presented in Table1 and Table 2 respectively.

Table 1: Orobanche Infestation in Rapeseed area

Crop	Orobanche Infestation Nos./'000ha	
	Patradisa	Arnarn Teplong
Mustard Variety -	1-2nos only	0
Toria Var. TS-38	721.8	350.9
Local	732.6	355.7

Table 2: Average yield of rapeseed and mustard in different areas of KA & WKA Districts

Crop	Yield(Kg/ha)		Reduction in the yield of rapeseed from potential yield (%)	
	Patradisa	Arnarn Teplong	Patradisa	Arnarn Teplong
Mustard Variety – PM-28	1033	1160	-	-
Rapeseed Var. TS-38	774	846	22.6	15.4
Local Var. Rapeseed	660	675	34.0	32.5

From Table 1 it can be observed that the infestation of Orobanche in both HYV and local varieties of rape seed fields was very severe. The number of orobanche in rapeseed field was recorded to be 721.8 thousand numbers per hectare in HYV area and 732.6 thousand numbers per hectare area in local variety of Patradisa while in Arnarn Teplong the infestation was recorded to be 355.7 thousand

numbers per hectare area in HYV area of rapeseed and 350.9 thousand numbers per hectare area of local variety of rapeseed. The higher infestation of orobanche in the local variety field than that of HYV field might be due to the result of some changes in agronomic management where recommended package of practices was followed while farmers do not apply any organic manure or fertilizer in the local varieties (Gibot *et.al.* 2005) [5].

In table 2 it is revealed that in spite of high infestation of orobanche in the field yet the yield of HYVs was observed to be higher than that of farmers' local varieties. This might be due to the agronomic management in HYV's field by applying recommended dose of Borax which helped in better formation of siliqua. However, the yield of the local varieties was lower due to formation of false siliqua without any application of Borax. Rapeseed and Mustard as a Brassica group generally has a high Boron requirement (Mengel and Kirkby 1987) [11]. Gupta (1980) [6] reported that application of boron increases the siliqua formation of mustard plant while Islam (1994) [8] reported that the deficiency of boron in mustard may cause infertility leading to less pods formation and less seeds per pod and lower seed yield. A positive response of mustard to B fertilization has also been reported (Saha *et al.* 2003; Jaiswal *et al.* 2015) [9, 14] and often the farmers do not apply B, as a result the yield and quality of the crop decline Yadav *et.al.*, 2016 [16] reported that the number of siliqua plant⁻¹ significantly increased with varying levels of B.

Habimana *et al* [7]. reported that Broomrapes (*Orobanch* sp.) are a root holoparasitic plant devoid of chlorophyll and entirely depending on the host for nutritional requirements. They cause considerable yield losses (5-100%) in the crops, especially in the drier and warmer areas of Europe, Africa and Asia where it is reported to mainly parasitize species of leguminous, oilseeds, solanaceous, cruciferous and medicinal plants. In the present study, similar result was observed and the yield reduction percentage due to infestation of orobanche was found to be 22.6% in rapeseed (toria) HYV plots and 34% in farmers' local varieties plots of Patradisa village while it was 15.4% and 32.5% in HYV plots and local varieties plots of Arnam Teplong village. Similar findings were also reported that there is significant reduction of plant height, number of branches, number of siliquae per plant, seed per siliqua which ultimately led to seed yield loss ranged from 15 to 25% in mustard varieties due to infestation of *Orobanch* (Anonymous, 1993).

The high infestation of orobanche in the study area of Karbi Anglong and West Karbi Anglong Districts might be due to the climatic condition which is favourable for the widespread occurrence of orobanche and the effect of flood which occurred two years back. As a result of which the seeds might have been dispersed by water. This confirms the findings of Parker (2016) [12] who reported that the seeds of *Orobanch* can be readily dispersed naturally by wind and water and the favourable climate required for its occurrence is warm temperate climate with dry summer- warm temperature >10°C, Cold average temperature > 0°C.



Orobanch infestation in rapeseed



Orobanch parasite root attached to the root of rapeseed

Fig 1: Orobanch infestation in Rapeseed in Karbi Anglong and West Kabi Anglong District of Assam



Fig 2: Orobanch infestation in Mustard field of Karbi Anglong and West Kabi Anglong District of Assam

Conclusion

From the above observations it can be concluded that the high infestation of Orobanch in rapeseed areas of Karbi Anglong and West Karbi Anglong Districts might be due to the climatic condition which is favourable for the widespread occurrence of orobanche and the effect of flood which occurred two years back in both the areas. The intensity of infestation was much more in rapeseed area but the infestation in mustard areas was almost nil and the reason might be due to the effect of its high pungency or presence of glucosinolates in mustard which are important precursors in mustard species, responsible for their flavour and odour development and sulphur. But, further research is needed in this line.

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