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Orobanche Species Distribution And Severity Of Infestated Areas In South And North Wollo Zones Of Amhara Region, Ethiopia

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ABSTRACT

Broomrapes (*Orobanche species*) are obligate holoparasitic flowering plant. *Orobanche species* are root parasite which can damage the crops underground before the weed emerged. Complete faba bean yield loss by this weed forced farmers to replace faba bean by cereal crops. The distribution of the weed is increasing annually. To obtain relevant information on the introduction and distribution of the weed, survey was conducted on randomly selected 72 farmers' fields in 12 woredas in two zones, south and north Wollo. Four woredas, Kutaber, Dessie-zuria, Tenta and Mekidela are out of legumes production in south Wollo. In this survey, information was also gathered regarding farmers attitude and local control practices. Farmers practice is hand weeding but Orobanche shoots were emerged again in doubling and tripling. We cannot stop the dissemination of the weed due to the nature of dispersed agents such as wind, flood, farm machinery, crop seeds, animals, humans etc and the undulating features of the areas are all favorable agents to disperse the minute seeds of the parasitic weed and are beyond our capacity to control them, but we may bring a solution by multi-sector approach through developing resistant varieties using molecular breeding and with chemical control measures

Keywords:
chemical, faba bean, hand weeding, holoparasitic, resistant

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INTRODUCTION

Broomrape*s (Orobanche species)* are holoparasitic flowering plants native to the Mediterranean region (North Africa, the Middle East, and southern Europe) and western Asia where large areas ranging from 5-100% infestation have been recorded (Besufekad *et al.,* 1999). Their range extends to similar climates in Asia, Africa, Australia, and North-South/America where they also cause significant crop damage. The parasitic is on a wide range of food legumes such as faba bean (*Vicia faba* L.), field pea *(Pisum sativum* L.), lentil (*Lens culinaris)*, vetch *(Vicia* species), Solanaceae crops (eggplant*, tomato, tobacco,* and potato), oil crops sunflower (*Helianthus annuus), Noug (Guizotia abyssinia), linseed (Linum usitatisimum) and root crops carrot (Daucus carota* L.) .The severe invasion of legume crops, especially faba bean and field pea is by *Orobanche crenata* (Besufekad *et al.,* 1999).

Orobanxhe is thermophilic (warm-loving); frequently require dry condition and light soils. A medium-sized single *Orobanche* (Broomrape) plant can produce more than 400 flowers, and each flower produce around 500 extremely small (0.15-0.5 mm long) seeds, a total of 200,000 seeds can produce per single plant and are dispersed by wind, birds, animals, crop seeds, humans and farm machinery. It is propagated by seeds which can remain dormant in soil for several years. They can survive and able to remain viable in the soil for more than 10 years (Linke *et al.,* 1989).

As the survey indicated, *Orobanche crenata* is found in the faba bean, field pea, lentil and vetch crops mostly in mid altitude (2620 masl) on light soils up to the high altitude (3111 masl) on clay soils, but *Orobanche ramosa* is mostly found in high altitude (around 2977 masl) on acidic soils on linseed and Camelina crops. *Orobanche minor* is found attaching to some weedy plants like alfalfa (*wajima*) on mid altitudes (around 1850 masl) on pastoral lands and O. cernua is on field pea and lentil.

Due to the complete devastation of faba bean by *Orobanche crenata*, farmers are forced to replace pulse crops by cereals and oil crops production in south Wollo (Kutaber, Dessie zuria, Tenta and Mekidela woredas). The replacement of faba bean by other crops will create a problem as far as sustainable faba bean production for food security, disease and insect breaks for cereal crops and foreign currency earning is concerned.

Although Wollo is considering an area of the largest collection of faba bean accessions (Besufekad *et al.,* 1999); the production that should have been obtained was not achieved due to various production constraints. From those constraints, the parasitic weed, *Orobanche,* is a priority problem that has become an obstruction to legumes production. The damage of the weed starts underground at the flowering stage of faba bean and for field pea before flowering. After the weed emerges above ground, the legumes soon wilt and then dry without any pod setting.

Therefore, this survey was initiated with the objective of determining the introduction, distribution, and intensity of the infested food legumes producing areas in south and north Wollo by the weed.

MATERIALS AND METHODS

A field survey was conducted in randomly selected on south Wollo zone 10 Woredas: Kutaber (3 kebeles on 11 peasant associations), Dessie-zuria (5 kebeles on 12 peasant associations), Tenta (5 kebeles on 10 peasant associations), Mekidela (4 kebeles on 10 peasant associations), Tehuledere (6 kebeles on 6 peasant associations), Albuko (5 kebeles on 7 peasant associations), Woreilu (5 kebeles on 8 peasant associations), Jamma (6 kebeles on 9 peasant associations), Legehida (3 kebeles on 5 peasant associations) and Legambo (6 kebeles on 6 peasant associations); on north Wollo zone 2 woreds: Wadila (6 kebeles on 8 peasant associations) and Meket (5 kebeles on 7 peasant associations) a total of two zones, 12 Woreds and 72 peasant associations.

Each peasant association in a Woreda is located in a range of altitudes 2620-2941, 246-2866, 2712-3111, 2752-2916, 2169-2430, 2354-2505, 2640-2872, 2573-2663, 2711-2741, 2327-2875, 1986-2977 and 2065-2890, respectively. *Orobanche* population is determined by counting in each farm using a one quadrant (1m x 1m) space to know the infestation and distribution of

Table 1: Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Kutaber woreda	Kebele	Gall	A. blight	C. spot	Wilt	O.crenata
Manushi	011	H	M	M	L	H
Manushi	011	M	L	L	L	H
Kelekel	011	M	L	L	L	H
Kelekel	011	L	L	L	L	H
Amemott	011	L	L	L	L	H
Shisha ber	011	M	M	L	L	H
Dolermed	010	H	H	M	L	H
Flagober	010	H	M	M	L	H
Flagober	06	M	M	L	L	H
Adisalem	06	M	M	L	L	H
Adisalem (near town)	06	M	M	L	L	H

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table 2: Severity level of faba bean farms on assessed peasant associations in kebeles within a woreda

Dessie-zuria woreda	Kebele	Gall	A.blight	C. spot	Wilt	O.crenata
Goshign gote	018	M	M	M	L	H
Kedijo – Kimir dingay	018	M	M	M	L	H
Kedijo	018	M	M	M	L	H
Kurkur	018	H	M	M	L	H
Asegedo	019	H	M	M	L	H
Ayata	019	H	M	M	L	H
Abaso kotu	019	H	M	M	L	H
Kotu	019	H	M	M	L	M
Gerado	02	L	L	L	L	M
Gerado	02	M	L	L	L	H
Gerado	02	M	L	L	L	M

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 3 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Tenta woreda	Kebele	Gall	A. blight	C. spot	Wilt	O. crenata
Tentadebir	014	H	M	M	L	H
Gedohulet	015	M	M	L	L	H
Chancha	015	M	M	L	L	H
Gedo goti	015	M	M	L	L	H
Tenta-debir	014	M	M	L	L	H
Tedat	014	H	M	L	L	H
Tedat	014	H	M	L	L	H
Abajaro	05	M	M	L	L	H
Abajaro	06	L	L	L	L	M
Abajaro	06	H	M	L	L	M
Kotikotoshi	08	H	M	L	L	M

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 4 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Mekidela woreda	Kebele	Gall	A.blight	C. spot	Wilt	O. crenata
Dedere	029	H	M	L	-	M
Kundi	06	H	M	L	-	H
Yejela	06	H	L	L	-	M
Solenagn	06	H	H	M	-	M
Deferge	02	H	M	L	-	H
Gerdeja	012	H	H	L	-	H
Abalaybel	012	H	M	M	-	H
Wadle	012	H	M	L	-	H
Yednta ber	02	M	M	L	-	H
Tilkit	02	M	M	M	-	M

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 5 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Tehudere woreda	Kebele	Gall	A. blight	C. spot	Wilt	O.crenata
Metekate (Asefa Amedie farm)	08	L	L	L	L	L
Bededo	01	M	M	M	L	-
Ababora ager	02	M	M	M	L	-
Doshegno	01	M	M	M	M	-
Sholaw	08	M	M	M	M	-
Bededo	01	M	M	M	L	-
Salmenie	01	M	M	M	L	-

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

the weed. In addition, a structured questionnaire was used to assess the introduction and distribution of the weed and also to assess the level of local controlling practices if there are any. Survey on the prevalence of the weed, *Orobanche*, was conducted at the time of pod setting. The survey also assessed the faba bean diseases such as faba bean Gall, Ascochyta blight, Chocolate spot and wilt.

Procedures used to determine *Orobanche* and diseases severity level is:

L = Less than 20 % is damaged,

M = 20-50 % is damaged and

H = Greater than 50 % is damaged.

RESULTS AND DISCUSSION

In south Wollo 13 and north Wollo 2 totally 15 woreds are potential faba bean producing woreds. From those 15 woreds 12 were selected for the survey. Kutaber, Dessie zuria, Tenta and Mekidela woredas are seriously affected by *Orobanche crenata.* In Kutaber and Dessie zuria woredas, the cropping pattern was completely changed that means cereals are rotated by cereals (wheat by barely or by tef and vs.) and the only flowering crops does not attack by *Orobanche* and used in rotation is fenugreek (it is spice crop).

Kutaber and Dessie-zuria woredas

Farmers believe that the weed appeared for the first time at Kutaber woreda in 1980 G.C at Kube kebele 10 peasant association and at Dessie-zuria woreda in 1983 G.C at Kedijo Dehit farm area (*Goshign-Ketena*) kebele 09 peasant association, but they were not aware of the introduction of the weed as that time. These woreds or peasant association seems to be the source of infestation for all other farm areas and woredas followed the wind direction like Tenta and then Mekidela woredas.

The previous surveyors**,** Asfaw *et al.,* 1993, Assefa and Endale, 1994, Bessufikad *et al.,* 1999 and Linke *et al.,*1989 were said " the parasitic weed (*Orobanche crenata*) is found only in two woredas, Kutaber and Dessie-zuria, but it would be expand to other areas". As they put their suggestions, the weed now covered other two woredas, Tenta and Mekidela. Our worry also, there are woredas like Saint and Delanta in the direction of the wind from Tenta and Mekidela which we did not touch by this survey, there may be infested by the weed. If solution is not found by multi-sector approach as soon as possible, the weed will expand and cover many areas and completely devastated all flowering crops at most within 15 years.

Peasant associations found in these two woredas, pulse crops growing completely stop for more than 30 years and no more talking about pulses growing, even chickpea and maize also attacked by this parasitic weed. The undulating feature & topography of the area (3-5% slope) of these two woredas along with dispersal agents of wind and flood contribute to the wide spread and possibility of contamination of neighboring woreds and grazing areas by *Orobanche crenata* (Besufekad *et al.,* 1999). Farmers believe that the application of manure during cultivation is a means of weed dissemination as it can contain live weed seeds.

Tenta and Mekidela woredas

The whole assessed faba bean production area, which was in the range of 0.05 – 0.50 ha., the prevalence and distribution of the weed *Orobanche crenata* is extremely high (Tables 1, 2, 3 and 4). The average prevalence level of the weed was more than 30 *Orobanche* shoots per faba bean plant and on an area of 1m x 1m, 50 – 250 *Orobanche* shoots were counted. All faba beans affected by Orobanche crenata are wilted and dropped their flowers, then; the crops will die without any pod. Farmers practice of protection is continually uproot with local implement called Ankase made from metal (an implement with sharp pointed end) and mattock. The removal of the weed by hand pulling is laborious (4-5 times weeding) and new flushes of the weed emerged in doubling and tripling after 2-3 days of weeding. In the effort to eradicate the weed by hand pulling much labors have been wasted which could otherwise been used for other farm activities. The infected faba beans have bad smelling even cattle are no eat (famers' said). According to farmers' information, crop loss could reach as high as 75 - 100 % in these two woredas.

Table: 9 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Legehida woreda	Kebele	Gall	A.blight	C. spot	Wilt	O. crenata
Dejmach	04	H	M	M	-	-
Siba	04	H	M	M	-	-
Kara godina (Ali Wasiye farm)	04	H	M	M	-	L
Tigagut	08	H	M	M	-	-
Majetie	05	H	M	M	-	-

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 10 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Legambo woreda	Kebele	Gall	A.blight	C. spot	Wilt
Kersolie	029	M	M	M	-
Finchiftu	034	H	H	L	-
Borda	05	H	M	M	-
Jaro	010	H	M	M	-
Shefo	09	H	M	M	-
Shure	011	H	M	M	-

Where L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 11 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Wadila woreda	Kebele	Gall	A.blight	C. spot	O. ramosa
Fikr enja	024	L	L	L	L
Tuncha	04	L	L	L	L
Tuncha	04	L	L	L	L
Kosaye	04	H	M	M	L
Misrabala	03	H	M	L	L
Akbory	01	30	L	L	L
Lideta	02	H	M	M	L
Rasmesk	017	L	L	L	H
Rasmesk	017	L	L	L	H

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 6 Assessed peasant associations in kebeles within a woreda of faba bean farms

Albuko woreda	Kebele	Gall	A. blight	C. spot	Wilt	O. crenata
Tota mender	012	H	M	M	-	-
Tosa felana	014	H	M	M	-	-
kote	012	H	M	M	-	-
korkie(endelbe)	02	H	M	M	M	-
Addis amboch	01	H	M	M	-	-
cara kori	011	H	M	M	M	-

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 7 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Wereilu woreda	Kebele	Gall	A.blight	C. spot	Wilt
Batel	013	M	M	M	-
Tulu sertu	03	H	M	M	-
Bushra mender	05	H	M	M	-
Baribu	013	H	H	M	-
Yebelo	07	H	M	M	-
kuyu/albiko	07	M	M	M	-
Jamma ber	01	H	M	M	-
Abawesen mender	013	M	M	M	M

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Table: 8 Severity levels of faba bean farms on assessed peasant associations in kebeles within a woreda

Jamma woreda	Kebele	Gall	A. blight	C. spot	Wilt
Albuko	011	H	M	M	-
Yedo	06	H	M	M	-
Tosign	017	H	M	M	-
Laygnaw degolo	012	H	H	M	-
Meja	018	H	M	M	-
Lay Gendero	011	H	H	M	-
Charo	06	H	H	M	M
Ketare	06	H	M	M	-
Jibat	08	M	M	L	-

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

Wadila and Mekete woredas

In these two woredas, we have found *Orobanche ramosa* especially at highland in the acidic soils on linseed and Camelina oil crops (Tables 11 and 12). It may be attack the legumes crops and may be follow *Orobanche crenata* in these woredas if we do not control the weed soon. In addition to *Orobanche ramosa*, *Dodder* (*Cuscuta*), the stem parasite is devastated the faba bean crop at Meket woreda 027 Kebele boarder of Lasta (Table 12) and the locality people called it 'ADIS'. Farmers of both high and low elevation areas were believed that the existence of the weed *Orobanche* is known growing along with shrub and bushes for a long period of time but "starting around 1980 G.C it became noxious weed for flowering crops" they said. The weed also used to treat wounds and sores, so farmers have suggested that the primary sources of infestation for the neighboring woredas and peasant associations were the use of the weed as a medicinal plant. Besides, the weed was thought to have been distributed is by means of farm tools and planting materials (seeds) from neighboring area.

Woredas like Tehuledere, Albuko, Wereilu, Jamma, Legehida and Legambo are free of *Orobanche species* (Tables 5, 6, 7, 8, 9 and 10) except Tehuledere at one farmer field (Asfaw Amede) one *Orobanche crenata* and Legehida also at one farmer field (Ali Wasiye) one *Orobanche crenata* are found, but the diseases are affected almost all the assessed areas.

CONCLUSION

The initial source of the weed in the country is unknown, but there was an assumption that *Orobanchae crenata* was introduced in to Ethiopia probably with imported crop seeds (Assefa and Endale, 1994). Another contradictory idea is, farmers' believed, that the weed was found under bushes or shrubs as long as since they know and they used to it as a medicinal plant for sore treating, but they did not know it is the parasitic weed. Around 30 years ago, the weed seen on farm land and became parasitic for cultivated crops especially for food legumes crops.

The *Orobanche* infestation coverage was in two woredas in some peasant associations before 15 years, but now it covered more than doubling. Due to the serious problem, farmers have been forced to exclude faba bean production and replace by other cereal and spice crops. This condition has a negative impact.

In the affected areas especially Kutaber and Dessie-zuria, people suffer with shortage of *wot* crops and food for their children, adults escape to urban areas to engage themselves in laborious physical jobs and old people remain without any assistant. One elder man said "if you bring a solution of this weed, I will give one ox for you." It is really the challenge of researchers.

Another observation we have seen is, on clay soil and water logging areas, *Orobanche* shoots emerging is very late almost at pod stage of the faba bean and few in number, on these areas the faba bean can give yields, hence farmers can cultivate faba bean by drain the water on these areas, but on light soil the *Orobanche* shoots are emerged before the faba bean fully flowered and on average more than 25 *Orobanche* shoots are present per single faba bean plant and no yield at all on light soils. Really *Orobanche* is the challenge of researchers and governmental bodies.

Special attention should be given to bring a solution for this holoparastic weed, *Orobanche crenata.* It covers large areas within some years, we cannot stop the dissemination due to the nature of dispersing agents (wind, floods, animals, crop seeds), the undulating features of the areas, the weed serve as medicinal plant etc, but we may bring a solution through chemical control measures and developing resistant varieties using molecular breeding.

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Table: 12 Severity level of faba bean farms on assessed peasant associations in kebeles within a woreda

Meket woreda	Kebele	Gall	A. blight	C. spot	O. ramosa
Abajora	-	H	M	-	-
Sisi	014	H	H	-	-
Gerda	027	H	M	-	-
Lakit abo	024	L	L	-	-
Fikr enja	024	L	L	-	L

Where: L = low (< 10 %), M = medium (20-50%) & H = high (>50%)

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