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Parasitic effects of broomrape (*Orobanche* spp.) on growth, yield and quality of tomato and its economic loss in agro-ecological conditions of Khanozai (Karezat Region) District Pishin, Balochistan, Pakistan

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Key words: Tomato plant, Parasitic plant, Vegetative growth, Physico-chemical, Environmental condition.

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Abstract

The purpose of study was to understand the parasitic impact of Broomrape (*Orobanche* spp.) on tomato (*Lycopersicon* spp.) and its economic loss in the study area. The inspiration of the holo-parasitic broomrape on vegetative growth, productivity, fruit quality, chlorophyll contents of leaves, and rate of photosynthesis and fluorescence of chlorophyll in tomato plantswere deliberated during the growing seasons of 2019. Experiment was performed on tomato plants (crop) grown on commercial basis in an open field area of Khanozai (Karezat Region) District Pishin, Balochistan, Pakistan in the outline of a complete randomized block design (CRBD), with three replicates. From the results it was noted that the occurrence of parasite powerfully condensed the aerial biomass, total yield and quality with 66.50% economic loss by temporary as an opposing basin for integrate, nonetheless extra prominently, through cooperating the competence of carbons assimilations through a decrease in the chlorophyll contents of leaves and rate of photosynthesis. Florescence of chlorophyll features including Fo, Fm, Fv and Fv/Fm were all changed in parasitic plants, representing that broomrapes effected plant were additional vulnerable to photo-inhibition. The marks of damages to theplant population were not dependent oneither the numbers or biomass of scrounging plant /host plant. From results it was also noted that as days after planting (DAP) increased (60 -135 DAP) the rate of infection of broomrape on host plant (including; chlorophyll fluorescence parameters, relative chlorophyll contents and photosynthetic rate) also increased respectively.

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Introduction

Tomato (*Lycopersicon esculentum*) is a nutritious fruit, but frequently used as a vegetable or in combination with other vegetables. It belongs to the family 'Solanaceae'. Tomato has low calorie vegetable; contain only 18 calories/100g. Ithas zero cholesterol level and also very less in fat concentration. It is extremely rich in anti-oxidants, nutritional fiber, mineral and vitamin. Fresh tomato constituted valuable level of vitamin 'A', flavonoids, antioxidants including ß-carotenes, xanthine and lutein, vitamin-C and a large amount of potassium. It transmit regular level of vital Bcomplex vitamins (folates, thiamin, niacin, riboflavin) as well approximately vital mineral such as irons, calcium, manganese and other trace elements (USDA National Nutrients database). Tomato production is inhibited through numerous problems, one of these problem is the parasitic weeds (Goldwasser *et al.,* 2001; Rubiales *et al.,* 2003), and the most hazardous weed is *Orobanche* spp. (Joel, 2007).Parasitic plants are those that are reliant on other autotrophic plants for existence, for partial or all of their life cycle. Parasitic plants belong to seventeen diverse families; only eight of them are considered as weeds. Witch weed (*Striga* spp.) and broomrape (*Orobanche* spp.) are the highest frugally significant parasitic weeds in cultured crops. Broomrape is phanerogamic-holo parasite that bout the root of numerous dicotyledonous crop (Ahmad*et al.,* 2018). These taxalacking chlorophyll (Baccarini and Melandri, 1967) and get carbon, water and nutrients by haustoria that attach the parasite with the host plant vascular system. Broomrapes have its place inthe family *Orobanchaceae*. The genus *Orobanche* has more than 150 species (Musselman, 1980) amongst which only a few parasitize agronomic crop. Broomrapes differ in host range. The main hosts of *Orobanche* are potato, tomato, carrot, eggplant and pepper. Tomato plant is the 2nd greatest significant vegetable cultivated throughout the world (Akhtar *et al.,* 2010). Rendering to the world processing tomato council the world-wide tomatoesfarmingexistence 37.1million metrics ton in 2018, that is 2% less than that of previous year (WPTC, 2018). Though, in Pakistan during 2016 the total production was 575923 tons that was grown on 60,307 hectares (Fact-Fish, 2018). It was noted that because of broomrape infestation the worldwide annual crop losses are $1.3 to 2.6 billion. The broomrape (*O. aegyptiaca* and*O. ramose)* damages are stated in Asia, Mediterranean areas and North Africa (Joel *et al.,* 2007; Fernandez-Aparicio *et al.,* 2009; Abbes *et al.,* 2007). Broomrapes are cotyledon flowering plants (Joel *et al.,* 2007) that accomplished to take carbohydrates from the phloem and mineral from the xylem of the host plant. According to the Lasur *et al.,* (2017); Fermandez-Aparicio *et al.,* (2009) the infection caused by *Orobanche* move to high productivity and quality damage and the key hazardof this weed create from its maximum rise rate and the lengthy viability in the soil (Abbes *et al.,* 2007).

Tomato is one of the main elements of Pakistani diets including Balochistan Province. Balochistan is the greatest tomato producing province of the Pakistan by 205.6 thousand tones/year followed by KPK and Sindh by the making of 153.1 and 80.4 thousands tones, correspondingly. In Balochistan mostly the tomato cultivatedmost of the year are Killa Saifullah, Quetta, Mastung and Khanozai. Actually the Balochistan produce an extensive range of fruit and vegetables. Among vegetables, the tomato is the 2ndmainvegetable produced in the country. The areas under tomato growth are about more then 47, 2420 hectares by estimated manufacture of 479.140 MT during 2017-18. Over the previous two years the Balochistan has arose as main producer of tomatoes by 42 %portion in national productions, trailed by KPK 34.5%, Punjab 14.5% and Sindh 9% share (Ahmad *et al.,* 2018). Killa Saifullah (Khanozai region) is the leading producer of tomato in Balochistan as well as in the country (Pakistan horticulture development and export board Islamabad). Many farmers of the study area (Khanozai region) depend on tomato production as the main cash crop in their farms due to its production period (9-11 month in greenhouse and 3 months in open field).In Balochistan the one of the major problems of agricultural production is the noxious parasitic weeds broomrape locally known as"Sozgul/Halouk". It has been recognized as destructive root - parasite on Solanaceous.Its parasitic nature is the cause of the huge reduction in crop yield especially tomato crop in various regions of Balochistan province. In Balochistan the *Orobanche*plant have been found in the regions like Pishin, Killa Saifullah, Quetta, Kalat etc. Districts and these regions had dry cold climate. The cropping of potato and tomato in these region lead to very high level of infestation of *Orobanche* spp. and yield losses. Therefore, this research was conducted to assess the effects of *Orobanche* spp.on tomatoes plants growth, yield, quality and economic loss in agro-environmental conditions of Khanozai (Karezat Region) District Pishin, Balochistan, Pakistan.

Materials and methods

Study sites,growth condition, plant Material, experimental design and data collection

The study was conducted over the 2019 in open field area of Karezat region (Khanozai), district Pishin. The study was done in the outline of a complete randomized block design (CRBD) by triplicates. The environment of the study area (Khanozai region) is moderately dry and cold with average annual rainfall 270mm.

The average annual temperature is 14.5°C. Precipitation was lowest in September 2019 by an average of 1.0 mm. In January greatest precipitation falls by an average of 53mm. the soil of the study area consist of sandy loam mixed pebbles and rock wreckages. For data collection a survey was conducted in the open field area of Karezat region (Khanozai), district Pishin during 2019.Datawas noted at ripening phase of plant with triplicate. Existence of parasites plants (*Orobanche* spp.) Were observed in14hectare and separatedin to ten sample locations arbitrarily and then average was noted. Tomatoes plant were removed to the elevated bed's 2.5×10ft. Plant to plant space was 75cm and bed to bed space was 60cm. Individual bed confined 10-12 tomatoes plant. Parasitized weeds (*Orobanche*spp.) were calculated from 40beds arbitrarily designated from individual sample block.

Fluorescence chlorophyll

Chlorophylls fluorescence's parameter (Fo and Fm) were noted by a moveable fluorescence introduction display (Moveable fluorescence inductions monitors, "Fim, 1500," Alma Groups Company, Hoddesdon, Hert, England). The fresh completely prolonged leafs (typically the 3rd or 4th leafs from the top) was hold in the dark for 30min among 10:30AM and 12:30PM. The dark version times were obligatory to find a stable state values for ratio of variables to supreme fluorescence. Leaf clips were used to completely expose of 5 plants sampled randomly from the midpoint of individual plot. Six measurements, with a saturating light level up to 3,000 mmols/m^2 s, were taken between June 20, 2019 and August 20, 2019.Triplicate readings were taken between 60 and 135 day after planting (DAP) on each leaf (by the interval of 15 days).

Rate of photosynthesis measurement

Rapid leafs photosynthetic rate was measured at noon with a 250cm^3 chamber in the closed tour(Moveable Photosynthetic system, "Li-6200" Moveable Photosynthetic system, "LI-COR Inc., Lincoln, NE 68504") 60 to 135 DAP. All dimensions were taken from upper of the freshest completely prolonged leaf (classically the 4thleaf from the top), usually on pure sunlit days through photo synthetically active radiations of 1500 – 1900mmol photons/m^2/s. At individual time point the triplicates measurement were taken from the same leaf 5 plant/plot beforehand use for chlorophyll fluorescence's examination.

Chlorophyll contents and growth of host plants

Comparative chlorophyll contents were calculated by a moveable chlorophyll meter. Triplicate interpretations were taken between 60and 135 DAP (by the intermission of 15 days) on individual leaf of same 5 plant utilized to measured chlorophyll fluorescence and photosynthesis rate. On maturity, the aerial parts of 5 plants/ plot comprising of fresh leaves, stem and fruits were collected at the end of June and July 2019. Approximately 100gm of each were dried in an oven at 105°C for 72 hr for the determination of aerial dry weight of individual plant and oven dry weight of one *Orobanche* spp. was also noted (g/plant) through electrical balance.

Numbers of parasitic weeds/plant

The No of parasite was recoded on ripening stage of the plant. The entire No of parasite on cultivated bed on individual host plant was noted arbitrarily from the sampler beds and then average was made to compare the relative occurrence of parasites weed amongst all sampling locations as the techniques used by Ahmad *et al.,* (2018).

Fresh weight of infected and non-effected plants

The infected and non-effected plants were arbitrarily gathered on ripening phase from the cultivating bed ininvestigationaldeliberations. The fresh weight of infected, healthy tomatoes plants and fresh weight of a related parasitic weeds were measured with prudently remote from the host plants in grams (g) with the help of electrical balance (Ahmad *et al.,* 2018). The height of infected and non-effected plant was noted on ripening stage in centimeter by measuring tapes. The leaf area was calculated through leaf area meter or graph paper method as used by Leghari and Zaidi, (2013).

Economic loss assessment

The inhibition of plant was calculated by the following formula;

$$\text{Plant Populations} = \frac{43560}{(R \times R)\ (P \times P)} \text{(Eq 1.)}$$

Where, 43560 square feet is the area of 1 acre, R × R is distance in feet between row to row and P × P is the distance in feet between plant to plant.

Thus the plants populations obtain was further use to evaluate the economic damage through increasing byyield/plants and rates per Kg of tomatoes in wholesale market as the methods used by Ahmad*et al.,* (2018).

Fruits quality determination

For fruit quality measurement the following physico-chemical characteristic of effected and non-effected tomato plant measured were as follow;

Fruit moisture contents (FMC) was determined by the method of AOAC, (1995) as used by (Horwitz, 2010). 10.0 g fresh tomato fruit sample was dried in an oven for 24h at 70°C and moistures content was found in gm water g-100 samples. For the calculation of TSS and TA 10 tomato fruits samples were collected randomly from both plants (effected and non-effected). Individual fruit was divided into fragments and mixed in an electrical blender in order to get the fruits liquid. Afterward, fruit juice was strained by means of a Whatman No. 4 filter papers and the remaining part was used to find out the TA and TSS. TSS was noted for individual fruit sample in triplicates by the utilization of a numerical refracto-meter (Atago Co., Japan) at 20°C and stated as % age. TA was calculated by 5mL aliquot of liquid which was titrated at pH 8.1 by Hanna, GLP pH meter HI 111 by 0.1 mol/L NaOH (essential to neutralization of the acid of tomatoes in the occurrence of phenolphthalein) and the result was shown as % age of citric acid of fresh tomatoes weight. Ascorbic acid was quantifiably noted adaptation to 2, 6-dichlorophenol indophenol-dye, the process as defined by Jones and Hughes, (1983) with slightly modification. Canopy temperature (°C) of canopy was noted by the use of canopy thermometer.

Statistical study

Statistical study was done through ANOVA and LSD test. The % age decrease and increase in different parameters between the effected and non-effected plant was also calculated by using the micro software SPSS program version 16.0.

Results and discussion

Chlorophyll contents, photosynthetic rate and chlorophyll fluorescence parameters

Data indicated that the scrounging spell produced a massive decrease of tomato leaves chlorophyll contents. The total chlorophyll concentration of effected plants was absolutely reduced (by, 29.17%) as compared to the level of upheld by the non-effected control (Table 1). The average initial florescence (Fo), that signifies the basal release of chlorophyll florescence once the redox component of photosystem are completely oxidized was augmented by the parasitic attack of broomrapeon effected tomato plant by 14.60% (Table 1). The average maximum florescence (Fm) reproduces the condition in entirely soaked irradiance, once the electrons are completely decreased. The tendency of Fm over the time is represented in Table 1.

Table 1. Parasitic effects of Broomrape on chlorophyll contents and chlorophyll fluorescence parameters on the tomato plants.

Parameters	Effected plant	Non-effected plant	% age change	P value
Relative chlorophyll contents (spad units)	34	48	-29.17	**
Fo	738	644	+14.60	*
Fm	2676	3523	-24.04	**
Fv	1938	2879	-27.02	**
Fv/Fm	0.75	0.79	-5.06	*
Rate of Photosynthesis (µmol CO_2 /m²/ s)	9	15	-40.0	***

Each value is the average of 3 replicates, *, **, *** and NS; significantly different at P≤0.05, 0.01, 0.001 and nosignificant, respectively.

The Fm value in infectious plant at the dates of measurements was found 24.04% lower than that of non-effected ones (Table 1). Variable florescence (Fv) reflect the significantly diminished by parasite attack, which was 27.02% less in effected plant as compared to the non-effected tomato plants (Table 1). Fluorescence variable (Fv) assumed through the variance of Fm– Fo reproduced the reduction at a given times of the prime electrons accepters, which in its oxidized phase, reduces fluorescence, (Jefferies, 1992).Ratio between Fv/Fm was significantly decrease (5.06 %) by parasitic attack tomato plant (Table 1).

Table 2. Initial and maximum fluorescence (Fo and Fm) in examined tomato plants.

Days after planting	*Initial fluorescence (Fo)*				*Maximum fluorescence (Fm)*			
	Effected plant	Non-effected plant	% change	P value	Effected plant	Non-effected plant	% change	P value
60	582	579	+0.52	NS	3457	3603	-4.05	*
75	590	580	+1.72	NS	3463	3655	-5.25	*
90	595	582	+2.23	NS	3475	3682	-5.62	*
105	620	581	+6.71	*	2935	3667	-19.96	**
120	780	580	+34.48	***	2723	3680	-26.01	**
135	820	588	+39.46	***	1805	3696	-51.16	***

Each value is the average of three replicate, *, **, *** and NS; significantly different at $P \leq 0.05$, 0.01, 0.001 and nonsignificant, respectively.

Butler and Kitajima, (1975) reported that the ratio between Fv/Fm is relative to the important harvest of photosystem II (PS II) and is well connected by the quantum productivity of net photosynthesis. Data indicated that the rate of photosynthesis was meaningfully reduced by the attack of parasite. Overall average measurement the rate for effected plant was 40.0% low than that of non-effected tomato plant (Table 1). Similar observation was also reported by Mauromicale *et al.,* (2008), they reported that the chlorophyll fluorescence characteristics such as initial, maximum and variable fluorescence and ratio between variable and maximum fluorescence (Fo, Fm, Fv and Fv/Fm) were all changed in parasitic plant, signifying thatbroomrape effected plants were greatest vulnerable tophoto-inhibition.

The initial fluorescence (Fo) was meaningfully augmented through the parasite bout from 105 DAP forward by 135 DAP, Fo of effected plant was 0.52% to 36.46% over that of the non-effected controls from 60 to 135 DAP respectively (Table 2).

Table 3. Variable fluorescence (Fv) and ratio between Fv/Fm in examined Tomato plant.

Days after planting	Fv = Fm - Fo				Ratio Fv/Fm			
	Effected plant FV	Non effected plant	% change	P value	Effected plant	Non-effected plant	% age change	P value
60	2875	3024	-4.93	NS	0.83	0.84	-0.91	NS
75	2873	3075	-6.57	*	0.83	0.84	-1.39	NS
90	2880	3100	-7.10	*	0.83	0.84	-1.56	NS
105	2315	3086	-24.98	**	0.79	0.84	-6.27	*
120	1943	3100	-37.32	***	0.71	0.84	-15.29	**
135	985	3108	-68.31	***	0.51	0.84	-35.10	***

Each value is the average of three replicate, *, **, *** and NS; significantly different at $P \leq 0.05$, 0.01, 0.001 and nonsignificant, respectively.

The maximum fluorescence (Fm) reflect its significant differences (5.25 %) at 75 DAP got its highest (51.16%) at the time of final measurement 135 DAP (Table 2). The variable fluorescence (Fv) response showed that the treatments effects was noticed and important through the time of the measurement 75 DAP with 6.57% decrease in effected plant with respect to the non-effected plant. In specific, a progressive Fv reduction in plants effected in the last three measurements 105 DAP-135 DAP was observed (24.32, 37.32 and 68.31 %, respectively) (Table 3).

Table 4. Relative chlorophyll Contents (spad units) and rate of Photosynthesis (μmol CO_2 /m²/s) in examined Tomato plant.

Days after planting	Relative Chlorophyll Contents (spad units)				Rate of Photosynthesis (μmol CO_2/m² /s)			
	Effected plant	Non effected plant	% age change	P value	Effected plant	Non effected plant	% age change	P value
60	45.3	57.5	-21.22	**	10.2	12	-15.00	*
75	43.0	56.5	-23.89	**	9.0	14.5	-37.93	**
90	38.0	56.0	-32.14	***	7.5	15.8	-52.53	***
105	31.5	54.2	-41.88	***	7.0	16.2	-56.79	***
120	24.3	53.4	-54.49	***	5.5	16.5	-66.67	***
135	16.0	53.0	-69.81	***	4.3	16.8	-74.40	***

Individual value is the mean of triplicates, *, **, *** and NS; significantly different at $P \leq 0.05$, 0.01, 0.001 and nosignificant, respectively.

The significant decrease in fluorescence ratio Fv/Fm was most marked at the time of the last three measurements at 105 DAP, 120 and 136 DAP by 6.27, 15.29 and 35.10 %, respectively (Table 3).

The variation in chlorophyll fluorescence in different DAP was also noted by Mauromicale *et al.,* (2008). They found that the contagion moderated the chlorophyll fluorescence characteristics including Fo, Fm, Fv and Fv/Fm. The decrease in Fv/Fm, encouraged by an effect on Fv, suggests damages to PS II electron transport. The measurements of chlorophyll fluorescence provide a non-destructive, rapid means of evaluating both photochemical quantum yield and photo-inhibition (Krause, 1988). Numerous extra pressures have been recognized in many crops species to principal fall in Fv/Fm (Kamis *et al.,* 1990; Lima *et al.,* 1999).

The parasitized occurrence instigated an important and progressive reduction of tomato leaves chlorophyll contents and photosynthetic rate.

The first significant decrease of tomato leaf chlorophyll content appeared at the time of the first measurement 60 DAP with 21.22% decrease, which increase gradually by the increase of time and reached maximum decrease at 135 DAP with 69 % (Table 4). The rate of photosynthesis in leaves of infectious plants decreased by the age of plant and in phase by the developments of parasite, while usually augmented over the corresponding retrains the non-effected plants (Table 4).

Table 5. Parasitic effects of broomrape on growth and yield characteristics of tomato plants.

Parameters	Effected plant	Non effected plant	% age change	P value
Total aerial biomass (gm/plant dw)	236	512	-53.91	***
Leaf weight (gm/plant dw)	61	143	-57.34	***
Stem weight (gm/plant dw)	33	85	-61.18	***
Fruit weight (gm/plant dw)	124	310	-60.0	***
Leaf weight/Fruit weight (gm dw)	0.49	0.46	+6.52	*
Branched broomrape dry weight (gm/plant)	15.2	0	-	-
No. of fruit /plant	21.2	52.3	-59.46	***
No. of branches/Plant	5.2	9.5	-45.26	***
Plant Height (cm)	50.3	68.9	-27.00	***
Leaf area (cm^2)	24.34	28.14	-13.50	*

Individual value is the average triplicates, *, **, *** and NS; significantly different at P≤0.05, 0.01, 0.001 and nosignificant, respectively.

The final result was an alteration of 15 % at the time of the first measurement 60 DAP and gradually increase at the last measurement 135 ADP with significant decrease of 74.40% in effected plant with respect to the non-effected plant (Table 4). The meaningfully dropping chlorophyll contents and photosynthesis rate lead to special effects rises over the time as described by Mauromicale *et al.,* (2008). In their study, they noted that the occurrence of the parasites powerfully bridged the aerial biomass through as a rival surface for integration, none the less extra significantly through conceding the competence of carbons integration by a lessening in leaf chlorophyll content and photosynthesis rate.

Table 6. Parasitic effects on physico-chemical characteristic of examined tomato plants.

Parameters	Effected plant	Non effected plant	% age change	P value
Fruit Moisture Contents (SMC)	51.38	85.0	-39.55	***
Ascorbic Acid	24.67	50.09	-50.75	***
Brix(TSS)%	12.0	5.0	+58.33	***
Titrable Acidity(TA) as Citric Acid%	1.75	0.95	+84.21	***
Canopy Temperature (°C)	24	24	0	-

Each value is the mean of three replicates, *, **, *** and NS; significantly different at P≤0.05, 0.01, 0.001 and no significant, respectively.

Parasitic effects of Broomrape on growth and yield characteristics of Tomato plants

Results indicated that parasite had significantly influence on the partitioning of dry matter between the various aerial organs (leaves, stems, and fruits), so that aboveground plant architecture was noticeably affected. Results in Table 5 showed that leaves, stem and fruit dry weights were 57.34, 61.18 and 60.0 % less as compared to the non-effected tomato plants. The source–sink relationship, as expressed by the ratio between the dry weight of the leaves and the dry weight of the fruit, was also significantly altered.

Consequences also exhibited that No. of fruit and No. of branches/Plant, were highly significantly low with 45.26 and 59.46 %, in effected plant than that of non-effected tomato plant, while plant height (cm) and leaf area (cm^2) were found 27.00 and 13.50% less respectively (Table 5). Inthe precise circumstances of these experimentations, the presence of parasitic plant (broomrape) was meaningfully and reliably related by a decrease in the vegetative biomass of its tomato plant, both temporary as an extra sink for incorporating and damaging the host plant photosynthetic capability.

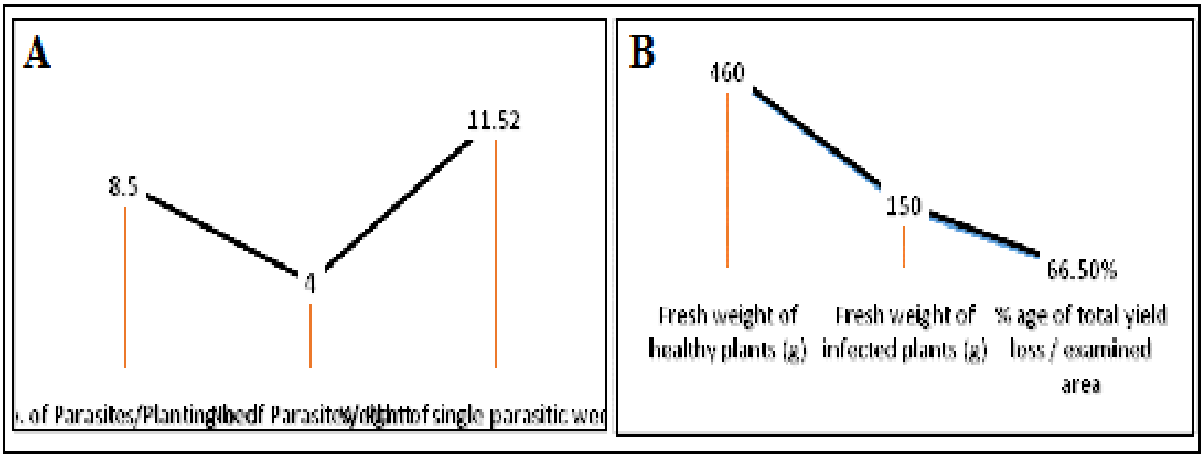

Fig. 1. Ashowed Occurrence of Broomrape and Fig. 1B indicated the loss of Broomrape in Khanozai (Karezat region)/plot, District Pishin Balochistan, Pakistan.

The parasite is not a chiefly largecarbon sink, in that the joint biomass of the effected host and parasite itself (the connotation biomass) was considerably lower in the growing season than that of the non-effected host plant. So, the alteration in host plant biomass between effected and non-effected plants is not accounted for with the biomass of the parasite, in agreement with the observations made by both white clover (*Trifoliumrepens* L.) and small broomrape (*O. minor*Sm.) (Dale and Press, 1998) and tomato/Egyptian broomrape (*O. aegyptiaca* Pers.) (Barker*et al.,* 1996). Current results indicated that the occurrences of parasite evidently repressed the growth of the host plant.

The aerial dry biomass of infected plants was 53.91 % less than that of the non-effected plants and statistical analysis showed highly significant variation between effected and non-effected tomato plants (Table 5). Observation recorded by Mauromicale *et al.,*(2008) was also in the favor these results; they found 61% and 72% less aerial dry biomass of the infected plants. Generally the parasitic attack did not affect the floral development of the host because effected and non-effected plants reached anthesis and fruit physiological maturity concurrently.

The average dry weight of broomrape shoot per effected tomato plant was found 15.2 g (Table 5). Similar result was also found by Mauromicale *et al.,* (2008), they found 12.4 g dry weight of broomrape shoots per tomato plant. According to the Ahmad *et al.,* (2018) the generalreviewdesignated the 65 – 70% plants hurt incomplete or whole yield loss. Additional, it was projected that the number of weeds inhabiting plant^{-1} was ranged from 2 – 4. Productivity loss was valued at 57.17 tons/ha, though interm of monetary loss, it was about 2579.87 $/ha. Hence total projected loss on the entire surveyed region of 16 hectares was 41395.85 $ (Ahmad *et al.,* 2018).

The great potential of tomatoes farming in Pakistan strengthens the vitaldefenseactions to resolution of this developing subject.

Occurrence and loss of broomrape in Khanozai (Karezat region)/plot, District Pishin Balochistan Pakistan

Broomrape (*Orobanche* spp.) are root holo-parasitic plant producing severe destruction to numerous families of gardening crops. Results in Fig. 1A and Fig. 1B, designated that each planting bed was found 8.5 average number of parasitic weeds similar consequences was also reported by other researchers. Aninitialstudy was done by Ahmad *et al.,* (2018) in tomato arenas verminous by*Orobanche* in Potohar region of Pakistan and designated that to each establishing bed comprising of 10 – 12 tomato plants delimited 7to 8parasite weed plants. In present investigation the average numbers of parasite effecting single host plant was noted 4.0. The average fresh weight of normal plant was found 460 g, while in effected plant was noted 150 g. complete relative weight of newly and effected tomatoplants exposed66.50 %variances. In the present investigation, the damages and invasion of *O. agyeptica* were noted by calculating the numbers of parasite on each plant and over individual establishing bed (Fig. 1A). The similar results were also noted by Ahmad *et al.,* (2018).

The observation recorded by Gil *et al.,* (1987) and Cubero, (1991) are also supportingthe entireresults. Data regarding broomrapeparasitic effects on physico-chemical characteristic of examined tomato plants are displayedin Table 6.Results indicated that Fruit moisture contents and Ascorbic Acid were significantly low in the fruits of effected plant as compared to the non-effected plant with decreasing % age of 39.55 and 50.75% respectively, while the Brix (TSS) and Titrable Acidity (TA) as Citric Acid were higher by the increasing % age 58.33 and 84.21 % in effected plant fruits with respect to the non-effected plant (Table 6).

However, canopy temperature (°C) was recorded same (24°C) in both tomato plants. So the current investigation designatedextensivechangesin the physico-chemical characteristics of effected and vigorous tomato plants. Previous investigations on tomato alsoapproved current findings, where vulnerable cultivar has decreased 80% root weight and 94% shoot weight. Likewise, productivity decrease was 65 to 70% in the entire region. Though, effected plants have been testified before to decrees the productivity up to 90% (Sawafta, 2012).

Conclusion

From current study it has been concluded that contagion bybroomrape parasite constantly decreases the aerial growth and fruit productivity of tomato crops grown in agro-environmental circumstances that lead to the economic loss. Its performances as an additional sink for host plant integrate; nonetheless cause damages mainly through its bad consequence on photosynthetic activity of the host plant.

The infections are probably made with a reduction in the chlorophyll contents of leaf through inhibition of the main light responses and with the decreases in mesophyll conductance. Furthermore, investigation is needed to evaluate the potential of agronomic characters and environmental operation that could minimize the plants susceptibility towards parasites. Current study concluded that Broomrapes (*Orobanche* spp.).

Theroot holo-parasitic plant producing severe damages to numerous agricultural crops. To maximize the rate of photosynthesis and chlorophyll contents of leaf and the capability to minimalize photo-inhibition might be developed as unintended examines for better tolerance to broomrape.

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