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Host range of *Colletotrichum gloeosporioides* isolated from various crops in Western Maharashtra Maharashtra

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Abstract
Present investigation reveals the host range of *Colletotrichum gloeosporioides* isolated from various crops by cross inoculation method. Forty one diseased specimens were collected from different localities of Western Maharashtra and subjected to tissue isolation on PDA. Out of 41 specimens obtained from different hosts, 14 isolates from 14 various hosts were found to be pathogenic when inoculated on respective plant part. These 14 isolates were used for further study and further abbreviated as Cg-1 to Cg-14. The identification of isolates was confirmed from their morphology. Among all these 14 isolates, Cg-5 *i.e.* from mango found more aggressive, which was on par with Cg-2 *i.e.* from custard apple. All these isolates were produced typical anthracnose or fruit rot symptoms on various host crops upon artificial inoculation. Almost all these 14 isolates produced typical symptoms of *C. gloeosporioides* on various host crops within 7-10 days upon artificial inoculation. Among all, Cg-1, Cg-2, Cg-4, Cg-5 and Cg-8 were found highly aggressive, which were isolated from pomegranate, custard apple, guava, mango and chilli respectively. The isolates obtained from Amaryllidaceae (Onion and Garlic) family was able to infect, the crops only belongs to the same family. But isolates, obtained from crops of other family can infect the crops of Amaryllidaceae (Onion and Garlic) family. Finally it can be concluded that all the isolates of *C. gloeosporioides* collected from various crops of Western Maharashtra, showed wide host range according to locality.

Keywords: *Colletotrichum gloeosporioides*is, aggressiveness, host range

Introduction
The Western Maharashtra region majorly contributes for the production of fruit, vegetable, cereal, flower, medicinal and ornamental crops. The production of these agricultural crops has many problems particularly, fungal diseases. Among these, anthracnose or fruit rot caused by *Colletotrichum gloeosporioides* is most destructive disease and known to cause great losses to the fruit growers in terms of both quality and quantity (Phoulivong *et al*., 2010) [11]. It causes anthracnose, die back, whither tip, shot hole, leaf blight and post harvest rots in many economically important crops such as cereals, pulses, vegetables, fruits, spices and cash crops.
Colletotrichum gloeosporioides cause typical disease symptoms known as anthracnose, characterized by sunken necrotic tissue, produced in lesions on petioles, leaves, mummified inflorescences, flower bracts and on fruits (Dodd *et al*., 1992) [4] and can acts as continuous sources of inoculums. The most significant damage of this fungus occurs upon its attack on fruiting stage (Baily *et al*., 1992). Under such circumstances, the nature of the *C. gloeosporioides* will be the decisive factor in the epidemic development. Therefore, investigation on the basic and applied aspects of population biology of *C. gloeosporioides* is the need of time. It is also necessary to understand how the existing population of the pathogen interacts with the emerging population of the host species and varieties.
Colletotrichum gloeosporioides Penz. is a facultative parasite belongs to the order Melanconiales. The fungus produces hyaline, one-celled, ovoid to oblong, slightly curved or dumbbell shaped conidia, 10-15 µm in length and 5-7 µm in width. Masses of conidia appear pink or salmon colored. The waxy acervuli that are produced in infected tissue are sub epidermal, typically with setae, and simple, short, erect conidiophores. *Colletotrichum* produces conidia within black fungal fruiting bodies called acervuli. First, lesions appear as small, dark spots on stolons and petioles. With advance in age, these lesions, become larger in diameter. Brownish areas are formed by the conidial masses that cover the lesion center and are frequently produced in a concentric ring pattern (Ponte, 1996).
The pathogen *i.e. Colletotrichum gloeosporioides* is a ubiquitous, proliferate and economically important fungus which infect or affecting a wide range of hosts in the tropics and subtropics (Cannon *et al*., 2012; Weir *et al*., 2012) [3, 2]. *Colletotrichum gloeosporioides* known as

one of the world's most important pathogen, which is a species complex comprising morphologically indistinguishable but genetically isolated species and has been reported on broad range of hosts (Cai *et al.*, 2009).

Methodology

The present investigation was carried out during August 2014 to December 2017 at Department of Plant Pathology and Agricultural Microbiology, PGI, M.P.K.V. Rahuri, 413 722. The material used and methods and procedures followed to investigate the host range of *Colletotrichum gloeosporioides* were as follows.

Collection, isolation and pathogenicity

Collection of disease samples

Diseased specimens from different crops in the form of infected fruits as well as leaves and shoots were periodically collected on the basis of symptoms from Western Maharashtra region in the state by personal visit. The details of the same is as described in Table 1.

Table 1: Collection of disease samples collected from different crops in Western Maharashtra

S. No	Name of crop	Host part	Location		
			Place/Village	Tahsil	District
1	Pomegranate	Fruit	Akolevasud	Sangola	Solapur
2	Papaya	Fruit	Akluj	Malshiras	Solapur
3	Guava	Fruit	Rahuri	Rahuri	A.nagar
4	Strawberry	Fruit	Bhilar	Mahableshwar	Satara
5	Custard apple	Fruit	Jejuri	Purandar	Pune
6	Papaya	Fruit	Shirbavi	Sangola	Solapur
7	Mango	Fruit	Kothali	Shirol	Kolhapur
8	Strawberry	Fruit	Panchgani	Mahableshwar	Satara
9	Acid lime	Fruit	Varvand	Daund	Pune
10	Pomegranate	Fruit	Mahud	Sangola	Solapur
11	Custard apple	Fruit	Lonarwadi	Pandharpur	Solapur
12	Chilli	Fruit	Tawadi	Phaltan	Satara
13	Guava	Fruit	Aasu	Phaltan	Satara
14	Ginger	Leaf	Pusegoan	Khatav	Satara
15	Papaya	Fruit	Rede	Malshiras	Solapur
16	Turmeric	Leaf	Sangawade	Karveer	Kolhapur
17	Mango	Fruit	Khanapur	Bhor	Pune
18	Garlic	Leaf	Vidani	Phaltan	Satara
19	Maize	Leaf	Paniv	Malshiras	Solapur
20	Jasmine	Leaf	Pandare	Baramati	Pune
21	Turmeric	Leaf	Bujgoan	Miraj	Sangli
22	Strawberry	Fruit	Mahableshwar	Mahableshwar	Satara
23	Sweet orange	Fruit	Kashti	Shrigonda	A. nagar
24	Papaya	Fruit	Rajale	Phaltan	Satara
25	Mango	Fruit	Untwadi	Jat	Sangli
26	Jasmine	Leaf	Sangavi	Phaltan	Satara
27	Ginger	Leaf	Amnapur	Palus	Sangli
28	Custard apple	Fruit	Saswad	Purandar	Pune
29	Acid lime	Fruit	Kashti	Shrigonda	A. nagar
30	Mango	Fruit	Rahuri	Rahuri	A. nagar
31	Chilli	Fruit	Songoan	Phaltan	Satara
32	Guava	Fruit	Nira-Wagaj	Baramati	Pune
33	Ginger	Leaf	K.Digras	Miraj	Sangli
34	Turmeric	Leaf	K.Digras	Miraj	Sangli
35	Onion	Leaf	Nandurshingote	Sinnar	Nashik
36	Turmeric	Leaf	Nandani	Shirol	Kolhapur
37	Garlic	Leaf	Mirgoan	Phaltan	Satara
38	Onion	Leaf	Dahiwadi	Man	Satara
39	Sweet orange	Fruit	Mirajgoan	Karjat	A. nagar
40	Maize	Leaf	Tavashi	Baramati	Pune
41	Pomegranate	Fruit	Sonake	Pandharpur	Solapur

Isolation

With exception of pomegranate fruits all other specimens were subjected to tissue isolation. Infected specimens showing typical anthracnose, leaf blight, fruit rot or die back symptoms were brought to laboratory, washed thoroughly with distilled water and dried in the folds of blotting paper. The diseased patches on the surface of leaf, fruit or shoot were cut in to pieces of about 1 sq. cm in such a way that the cut piece will carry enough diseased portions along with some healthy part. The cut pieces were surface sterilized with 0.5% sodium hypochlorite for 30 sec followed by rinsing with three changes of distilled sterile water. The excess water on the surface of pieces was removed by placing them in the folds of pre sterilized blotting paper. Such pieces were then transferred aseptically on PDA previously poured in the petriplates. In each plate three pieces at equal distance were placed and such plates were incubated at 28^0 C temperature with 95% RH. After 48 hrs.of incubation, the plates were examined for development of visible mycelium growth. The typical growth around individual bit was transferred to PDA slant and incubated for 90-96 hrs. Temporary mounts were prepared to confirm the involvement of the fungus *C. gloeosporioides*. The growth obtained other than the desired fungus was discarded. In case of some fruit specimens showing pink-salmon coloured conidial growth on necrotic patches was directly transferred aseptically on the surface of PDA with the help of sterilized needle. Inoculated plates were inocubated at 28^o C temperature and 95 per cent RH for 48 hrs. The distinct mycelial growth was aseptically transferred to PDA slant. The cultures of C. *gloeosporioides* obtained were subjected to serial dilution to get monoconidial pure cultures. Such cultures were maintained further for confirmation of the pathogenicity (Table 2).

Table 2: Isolates of *C. gloeosporioides* collected from different hosts from Western Maharashtra region

Isolate No.	Name of the crop	Host part	Location		
			Place/ Village	Tahasil	District
Cg-1	Pomegranate	Fruit	Akolevasud	Sangola	Solapur
Cg-2	Custard apple	Fruit	Saswad	Purandar	Pune
Cg-3	Papaya	Fruit	Akluj	Malshiras	Solapur
Cg-4	Guava	Fruit	Rahuri	Rahuri	A.nagar
Cg-5	Mango	Fruit	Rahuri	Rahuri	A.nagar
Cg-6	Strawberry	Fruit	Mahableshwar	Mahableshwar	Satara
Cg-7	Lime	Fruit	Kashti	Shrigonda	A.nagar
Cg-8	Chilli	Fruit	Tawadi	Phaltan	Satara
Cg-9	Ginger	Leaf	Amnapur	Palus	Sangli
Cg-10	Turmeric	Leaf	Sangawade	Karveer	Kolhapur
Cg-11	Garlic	Leaf	Vidani	Phaltan	Satara
Cg-12	Jasmine	Leaf	Pandare	Baramati	Pune
Cg-13	Onion	Leaf	Nandurshingote	Sinnar	Nashik
Cg-14	Sweet orange	Fruit	Kashti	Shrigonda	A.nagar

Pathogenicity

For each isolates a separate pathogenicity test was carried out by detached leaf or fruit technique. The plant species and plant parts (*i.e.* fruits or leaves) from which actually the organism was isolated were used. *C. gloeosporioides* isolates from ginger, turmeric, garlic, jasmine (Mogra) and onion were inoculated on leaves of healthy plants of respective hosts in glasshouse.

While that of isolates from pomegranate, custard apple, papaya, guava, mango, strawberry, lime, chilli and sweet

orange were inoculated on healthy fruits of respective hosts. Leaves or fruits were washed with tap water, air dried, surface disinfected with 0.1 % mercuric chloride solution one minute followed by thoroughly but gentle rinsing with sterilized water for three times to remove the traces of disinfectant and subjected to fine injury on abaxyl surface with the help of carborundum powder so as to facilitate the entry of the germ tube. Thereafter, the fruits were kept on flask or beaker (100ml) by inserting the fruit stalk in sterilized water, which is previousely filled in them. The fruits were covered with sterilized polythene bags.

It was done to provide 24 hours pre-inoculation incubation of fruits as suggested by Manandhar *et al.* (1995) [10]. Next day the bags were removed and inoculation was made at the site of fruits. Seven to ten days old culture of respective isolate showing abundant salmon coloured conidial masses was added with little quantity of sterile water and conidial masses were separated from the culture with the help of scalpel. The conidial load in the suspension was adjusted to 10^6 conidial ml^{-1}. Such freshly prepared suspension was automised on the injured surface of leaves or fruits by micro-droplet inoculation technique (MDIT). A fine wet cotton swab was then placed on the inoculated portion of the leaves or fruits. A suitable control was maintained separately at every time wherein instead of conidial suspension, sterilized water was sprayed on the injured leaf or fruit. A set of inoculated plants was maintained in the glasshouse as well as in moisture chamber according to the inoculated plant parts i. e. leaves and fruits respectively, at 27^0C with more than 90 per cent RH for two weeks.

Reisolation was made from inoculated surface upon development of symptoms. The cultures obtained upon reisolation were compared with the respective original culture. Isolates fulfilling the pathogenicity test were accessed according to host. Cg was the common prefix representing the test fungus. All cultures were maintained in duplicate sets and stored in the refrigerator at temperature of 6-8^0C. All cultures were periodically sub cultured every after two months and maintained during the course of investigation.

Identification

Isolates fulfilling the pathogenicity test were tentatively identified on the basis of morphological and cultural characters with the help of available literature.

Cross inoculation for host range study

Cross inoculation study was undertaken in order to determine the host range of the isolates within the host genera under study. The respective plant parts of each host were inoculated with all isolates from various hosts. Inoculations were made in a similar fashion as described in the pathogenicity test. The degree of cross infectivity of each isolate on different hosts was confirmed upon reisolation.

The observations on Symptomology, Days required for development of symptoms and Aggressiveness of the pathogen were determined. Inoculated fruits or leaves were kept in the humid chamber for 10 days. The temperature at 28 ^{0}C and 90 per cent RH was maintained inside the humid chamber throughout the experimentation. Each crop was inoculated at two well isolated points in three replication. The data obtained were subjected to statistical analysis by Completely Randomized Design (CRD).

Results and Discusion

Isolation

In the present study, *C. gloeosporioides* was isolated in the laboratory on PDA. Isolations were made from fruit samples of pomegranate, custard apple, papaya, guava, mango, strawberry, acid lime, chilli and sweet orange which were collected from different parts of the Western Maharashtra. Similarly, *C. gloeosporioides* was also recovered from leaf samples of ginger, turmeric, garlic, jasmine and onion. *C. gloeosporioides* initially produced white profuse cottony growth around the host tissue placed for isolation within 72 hrs of incubation which later turned gray with formation of acervuli in some of the isolates within next 72 hrs. These findings are in similar lines as those reported by Hasabnis (1984) [5], Korade *et al.* (2001) [5].

Pathogenicity

Fruits of pomegranate, custard apple, papaya, guava, mango, strawberry, acid lime, chilli and sweet orange expressed initiation of typical fruit rot symptoms at the point of inoculation within 3-6 days after inoculation. Large necrotic round to irregular lesions developed in further seven to ten days. Symptoms development was rapid in pomegranate, custard apple, guava, mango and chilli fruits (72-90 hrs) followed by papaya, strawberry, acid lime and sweet orange (105 hrs). However, symptoms initiation was comparatively late in ginger, turmeric, garlic, jasmine and onion. It was observed that development of symptoms upon artificial inoculation was comparatively rapid when fruits were inoculated in comparison with the inoculation on leaves. These results are in confirmation with the findings of Talhinhas *et al.* (2005) [14]. They have proved the pathogenicity of *C. accutatum* and *C. gloeosporioides* with a representative set of isolates using fruits of 11 different olive cultivars and 'Camarosa' strawberry and obtained symptoms after 7 and 11 days on strawberry and olive fruits respectively. However, Hasabnis (1984) [5] reported a period of 48 – 72 hrs for development of artificial infection of *C. gloeosporioides.* In present study, it took a minimum period of 72 hrs for getting initial infection on either fruit or leaf which was inoculated artificially (Table 3).

Table 3: Pathogenicity symptoms produced by *C. gloeosporioides* isolates collected from different crops in Western Maharashtra

Isolate code	Crop	Symptoms	No. of days required
Cg-1	Pomegranate	Rotting was noticed from fruit end portion resulting into dark brown to black in colour.	8 – 9
Cg-2	Custard apple	Large necrotic round to irregular lesions were formed on fruits showing brown colour.	7 – 8
Cg-3	Papaya	Lesions were observed, which began as dark brown, punctate, circular to irregular spots of < 1.5 mm in diameter, often with distinctly graycenters.	7 – 8
Cg-4	Guava	Lesions appeared as dark brown irregular and that become sunken on the rind tissues.	7 – 8
Cg-5	Mango	Dark brown to black coloured spots were observed, which later coalesce to form sunken patches.	7 – 8
Cg-6	Strawberry	Brown spherical depressed spots occurred in scattered form on the pericarp. In advanced stage, spots coalesced to form necrotic rotten patches.	7 – 8

Cg-7	Acid lime	Spots may appeared as dark brown irregular and that become sunken on the rind tissues.	8 – 9
Cg-8	Chilli	Observed typical anthracnose symptoms including sunken necrotic tissues, with concentric rings of acervuli on Chilli fruits.	7 – 8
Cg-9	Ginger	Brown spots were observed, which later turns ellipsoidal or spindle shaped with halo. The affected leaves eventually turn brown and results in dry rot. Also this leaf spot characterized with small round to oval, light yellow spots on leaves and leaf sheaths, which gradually increase in size and coalesce to form large discoloured areas. The infected areas often dry up at the center, forming shot holes.	7 – 8
Cg-10	Turmeric	Brown spots were noticed on the upper surface of the young leaves, spots are irregular in shape and white or grey in the centre. Later, two or more spots may coalesce and formed an irregular patch covering almost the whole leaf.	8 – 9
Cg-11	Garlic	Observed typical anthracnose symptoms including sunken necrotic tissues on the leaves.	9 – 10
Cg-12	Jasmine	Observed the anthracnose symptoms on leaves. The spots were dark gray and mostly irregular shaped.	9 – 10
Cg-13	Onion	Observed typical anthracnose symptoms including sunken necrotic tissues on the leaves.	9 – 10
Cg-14	Sweet orange	Spots may appeared as dark brown irregular and that become sunken on the rind tissues.	7 – 8

Identification

The tentative identification of all 14 isolates was made on the basis of conidial morphology and cultural characters.

Cross inoculation for host range study and aggressiveness of isolates

All these 14 isolates of *C. gloeosporioides* isolated from different crops in Western Maharashtra were cross inoculated on various host crops for studying the host range and aggressiveness of isolates. The perusal of the Table 4, revealed that the isolate Cg-2 and Cg-5 from custard apple and mango respectively possessed the highest degree of infectivity irrespective of the different hosts, followed by Cg-8, Cg-1 and Cg-4. Among all these 14 isolates, Cg-5 *i.e.* from mango found more aggressive, which was on par with Cg-2 *i.e.* from custard apple. All these isolates were produced typical anthracnose or fruit rot symptoms on various host crops upon artificial inoculation.

Table 5, revealed that the, almost all these 14 isolates produced typical symptoms of *C. gloeosporioides* on various host crops within 7-10 days upon artificial inoculation. Cg-2 and Cg-5 were produced early symptoms (within 7-8 days) as compared to other isolates. While Cg-11, Cg-12, Cg-13 and Cg-14 were produced late symptoms (within 9-11 days). The isolates *viz.*, (Cg-1, Cg-3, Cg-4, Cg-6, Cg-7, Cg-8, Cg-9 and Cg-10) were produced symptoms within 7-9 days upon artificial inoculation.

Sanders and Korsten (2003) [13] reported cross inoculation potential of mango and avocado isolates on strawberry, pepper, guava, papaya and citrus. The cross inoculation of *Colletotrichum gloeosporioides* isolates obtained from cashew, acid lime, custard apple, pomegranate and guava could infect the leaves and fruits of mango, except the papaya isolate which failed to infect the leaves of mango, but produced infection on mango fruits. The isolate from cashew was more aggressive on leaves and fruits of mango and it recorded the maximum per cent disease index on leaves and fruits compared to other isolates with mean maximum. Papaya, acid lime and pomegranate isolates were least effective on mango leaves within 4-18 days after inoculation reported by Lakshmi *et al.* (2011) [9].

The results obtained are also on the similar lines of Wahid (2001) [15] obtained five isolates of *Colletotrichum gloeosporioides* from diseased guava fruits. The pathogen upon artificial inoculation showed a wide host range. It successfully invaded mango, pear and apple fruits. The five isolates showed different pathogenic potentialities towards the four tested fruit types. Kumara and Rawal (2004) [8] the host specificity of *Colletotrichum gloeosporioides* was studied by cross inoculation method, isolated from banana, mango, grape and pomegranate on papaya. Cross infection potential of mango, banana, grapes and pomegranate isolates of *C. gloeosporioides* along with papaya isolate on papaya was also studied. Both mango and papaya isolates had 100 per cent infection on papaya fruits. Banana isolate could infect only 90 per cent of papaya fruits while grapes and pomegranate isolates could not cause any infection on papaya within 7 – 14 days and Joshi (2008) [6] carried out the study on hast range and aggressiveness of 30 different isolates of *Colletotrichum gloeosporioides* and concluded that there was maximum diversity with respect to host preferences and the degree of infection to a particular fruitr type. However, none of the isolates was found to be host specific.

Table 4: Host range and aggressiveness of the different isolates of *C. gloeosporioides* on various host crops in Western Maharashtra

S. No	Isolates	Aggressiveness on various host crops (Lesion diameter in mm)													
		Guava	Custard Apple	Mango	Acid lime	Pomegranate	Papaya	Straw-berry	Chilli	Sweet orange	Jasmine	Turmeric	Ginger	Garlic	Onion
01	Cg-1	12.67	14.00	21.33	19.00	26.67	19.33	18.33	16.33	14.67	8.00	00.00	6.00	3.67	00.00
02	Cg-2	15.33	27.67	20.00	18.00	18.00	19.00	19.33	16.00	15.00	6.00	5.33	4.33	6.33	5.00
03	Cg-3	22.00	22.00	22.33	18.67	18.33	29.00	20.67	18.33	00.00	00.00	00.00	00.00	00.00	00.00
04	Cg-4	25.00	20.00	20.67	17.67	19.33	20.33	19.33	18.00	17.33	9.00	6.67	6.67	00.00	00.00
05	Cg-5	20.67	20.00	27.67	18.00	21.00	24.00	21.00	19.33	17.33	10.33	9.00	9.67	9.00	9.00
06	Cg-6	16.00	14.67	21.67	14.33	16.00	22.00	22.67	17.00	00.00	00.00	00.00	00.00	00.00	00.00
07	Cg-7	00.00	00.00	18.00	24.67	16.67	17.67	00.00	12.67	18.67	00.00	00.00	00.00	00.00	00.00
08	Cg-8	15.00	12.67	19.33	14.67	17.00	14.67	15.00	21.00	13.67	11.00	00.00	15.00	7.33	7.00
09	Cg-9	00.00	00.00	16.67	12.33	13.00	00.00	00.00	00.00	00.00	10.67	8.67	21.33	14.00	00.00
10	Cg-10	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	12.33	9.00	00.00	00.00
11	Cg-11	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	20.00	16.00
12	Cg-12	00.00	9.67	15.00	12.67	12.00	12.00	00.00	11.67	12.00	16.00	9.67	10.67	00.00	00.00
13	Cg-13	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	00.00	17.33	19.67
14	Cg-14	12.33	13.00	21.00	21.33	18.33	19.33	11.33	12.67	21.67	00.00	00.00	00.00	00.00	00.00
SE (±)		1.13	0.80	0.71	0.81	0.42	0.39	0.37	0.51	0.87	0.42	0.19	0.52	0.38	0.28
CD at 1%		4.43	3.14	2.78	3.16	1.70	1.56	1.46	1.99	3.40	1.66	0.78	2.07	1.52	1.10

Table 5: Number of days required for the development of symptoms on various host crops in Western Maharashtra of different isolates of *C. gloeosporioides*

S. No	Isolates	No. of days required for the development of symptoms													
		Guava	C. apple	Mango	Acid lime	Pomegranate	Papaya	Strawberry	Chilli	Sweet orange	Jasmine	Turmeric	Ginger	Garlic	Onion
01	Cg-1	10	8	8	8	8	8	8	8	9	10	-	8	10	-
02	Cg-2	8	7	8	8	8	7	7	7	9	8	8	7	8	10
03	Cg-3	8	7	7	8	7	7	7	7	8	-	-	-	-	-
04	Cg-4	7	8	7	8	7	7	7	7	8	8	8	7	-	-
05	Cg-5	8	8	7	8	7	7	7	7	7	9	8	7	8	10
06	Cg-6	8	8	8	8	7	7	7	7	-	-	-	-	-	-
07	Cg-7	-	-	7	9	9	8	-	8	9	-	-	-	-	-
08	Cg-8	8	8	7	8	8	8	9	8	9	9	-	8	10	10
09	Cg-9	-	-	8	8	9	-	-	-	-	9	8	8	11	-
10	Cg-10	-	-	-	-	-	-	-	-	-	-	9	8	-	-
11	Cg-11	-	-	-	-	-	-	-	-	-	-	-	-	10	11
12	Cg-12	-	10	9	9	9	9	-	9	9	10	9	8	-	-
13	Cg-13	-	-	-	-	-	-	-	-	-	-	-	-	10	12
14	Cg-14	10	8	10	9	9	9	10	9	10	-	-	-	-	-

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