

## Research Article

# Evaluation of Plant Extracts and Fungicides against *Fusarium udum* Causing Pigeonpea Wilt

Balkishan Chaudhary\*, Sanjeev Kumar and Shiva Kant Kushwaha

Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, MP, India-482004

**Abstract**

Eight fungicides viz., Captan, Blue copper, Carbendazim, Carbendazim + Mancozeb, Mancozeb, Fipronil, Thiophanate Methyl and Pyraclostrobin and seven plant extracts viz., leaves of Neem, Ashok, Parthenium, Castor, Citrus, Bulb of Onion and Clove of Garlic were evaluated to find out the efficacy of various fungicides and plant extract against wilt of pigeonpea. The broad-spectrum combination of Carbendazim + Mancozeb, Thiophanate Methyl and Carbendazim was found best fungicide which completely inhibited the growth of test pathogen. Garlic clove extract @15 percent was found best as it inhibited 62.8% growth *F. udum* under *in vitro* condition.

**Keywords:** Efficacy, Plant extract, Fungicides, *Fusarium udum*, Pigeonpea, Wilt

**\*Correspondence**

Author: Balkishan Chaudhary  
Email: chaudharybalkishan480@gmail.com

**Introduction**

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is the most important pulse crop of the India. It is suffered number of diseases like, Alternaria leaf spot, Phytophthora blight, Sterility mosaic and wilt. Pigeonpea wilt is a most destructive soil borne disease caused by *F. udum*. In India, it is the most serious problem all over the pigeonpea growing areas especially in U.P, M.P, Bihar and Maharashtra. The disease appears on young seedlings, but the highest mortality occurs during flowering and podding stage. Although the disease first appears in patches in a field and can extend to entire field if pigeonpea is repeatedly cultivated in the same field. The yield of pigeonpea is greatly affected by wilt disease caused by fungi *Fusarium udum*. However, loss in individual plant found nearly 100% when wilt occurred at pre-podding stage, 67% at podding stage and 29.5% at pre-harvest stage [3]. *Fusarium udum* is a host specific pathogen of pigeonpea. The fungus is primarily a soil borne facultative parasite and enters the host through fine roots and subsequently colonizes in different plant parts [5]. In view of significance of pigeonpea and the enormity of yield loss caused by wilt in Madhya Pradesh, the present investigation was undertaken to evaluate the potential of plant extracts, and fungicides against *Fusarium udum* under *in vitro* condition

**Materials and Methods****Isolation**

Pigeonpea plants showing characteristic symptoms of *Fusarium* wilt were collected from pigeonpea experimental field, Department of Plant Pathology College of Agriculture Jabalpur (M.P.) during *Kharif* season, for isolation and identification. The infected plant parts were cut in to small pieces and surface sterilized with 0.1 per cent mercuric chloride solution and washed thoroughly 3 to 4 times with sterilized water to remove the traces of mercuric chloride. The pieces were transferred in Petri dishes containing potato dextrose agar media and incubated at  $28 \pm 1^\circ\text{C}$  for 6 days. Pure colonies are isolated from inoculated Petri plates separately in aseptical condition. Isolate was identified as *Fusarium udum* by morphological criteria [6]. A single macro conidial culture was prepared from isolate. Studies of the management aspects of *Fusarium udum* isolate were conducted in laboratory.

**Efficacy of plant extract against *Fusarium* wilt**

In order to find out the efficacy of various plant extract against the *Fusarium* wilt, seven plant extracts viz., leaves of Neem, Ashok, Parthenium, Castor, Citrus, Bulb of Onion and Clove of Garlic, were used. Fresh leaves, bulb and Clove were collected and washed thoroughly in clean water. 100 g of each washed plant material was grinded in Pestle and Mortar by adding equal amount (100 ml) of sterilized water (1:1 V/W) and heated at  $80^\circ\text{C}$  for 10 minutes in hot water bath. The materials were filtered through double layered muslin cloth followed by filtering through

sterilized What man No. 1 filter paper and treated as standard plant extract (100%). The stock solution 5, 10 and 15 percent concentration were made by adding 95, 90 and 85 ml of sterilized PDA media to obtained 5, 10 and 15 percent concentration of plant extract. To study the inhibitory effect of botanicals on mycelial growth of *F. udum*, 5, 10 and 15 percent concentration were used by applying poison food technique. Seven treatments having three replications were maintained. Five mm discs of 7 days old culture of *F. udum* were cut with sterilized cork borer and placed in the centre of plant extract amended petriplates. The control petriplates having PDA alone were inoculated in the same manner. These petriplates were incubated at  $28 \pm 1^\circ\text{C}$  and observation on radial growth of test fungus will be recorded after 144 hours. Recorded data on radial growth was converted into percent growth inhibition by using following formula [13].

### *Efficacy of fungicides against Fusarium wilt*

The eight fungicides viz., Captan, Blue copper, Carbendazim, Carbendazim + Mancozeb, Mancozeb, Fipronil, Thiophanate Methyl and Pyraclostrobin along control was evaluated against *Fusarium udum* in by following the poisoned food technique under in vitro condition. PDA poisoned with each fungicide will be poured into three sterilized Petriplates @ 20 ml/plate and allowed to solidify. Plates containing PDA without fungicide served as check. After solidification each Petriplate was inoculated with 5 mm mycelial disc aseptically. Plates were incubated at  $28 \pm 1^\circ\text{C}$  and observation on radial growth of test fungus will be recorded after 168 hours. Recorded data on radial growth was converted into percent growth inhibition by using following formula [13].

## Results and Discussion

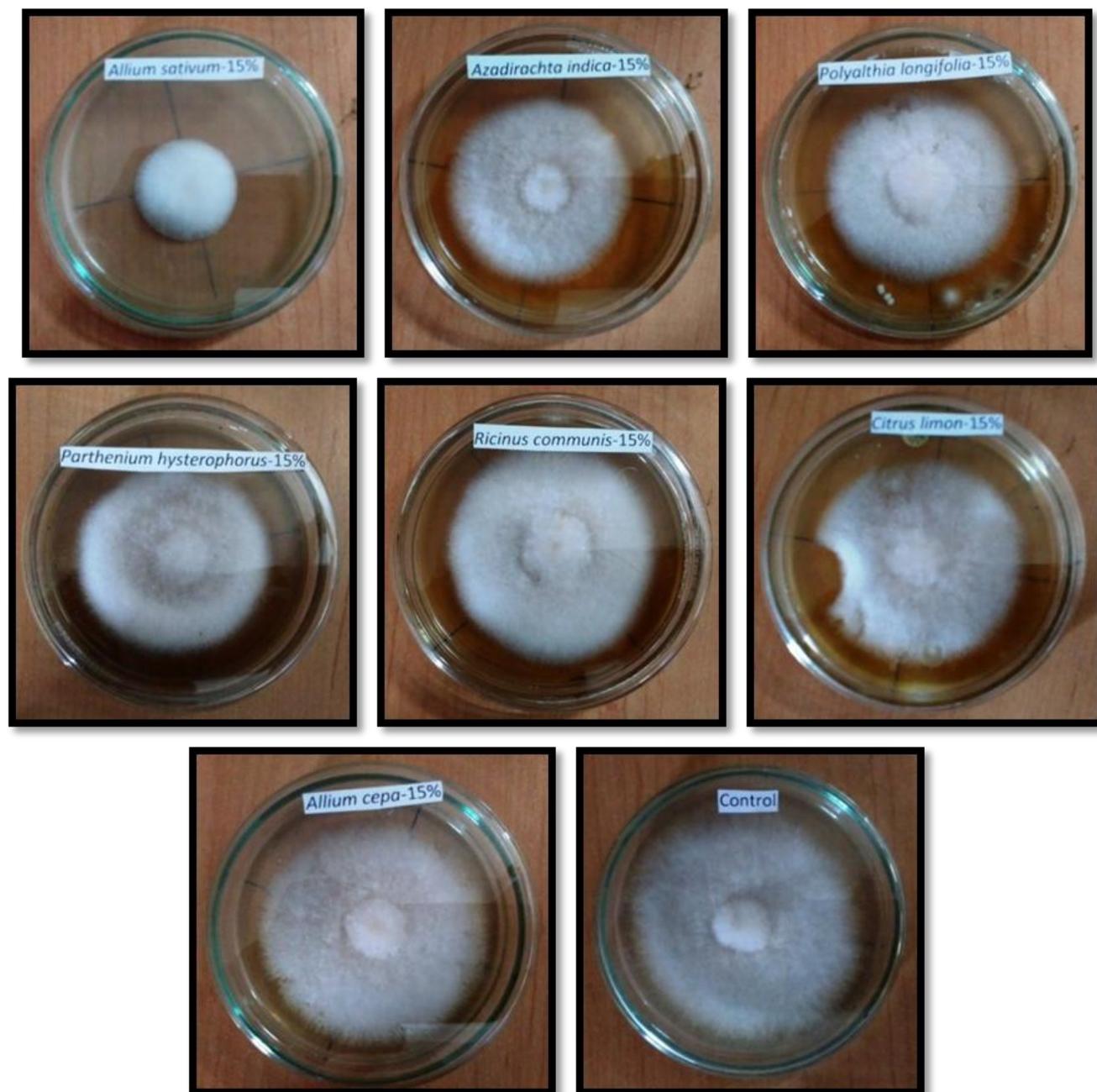
### *Efficacy of plant extract*

Garlic clove extract was found highly effective in inhibiting the radial growth of *F. udum* as it produced 62.8, 58.2 and 51.6 percent growth inhibition followed by Neem leaf extract which inhibited 34.4, 28.3 and 18.3 percent growth and Ashok leaf extract which inhibited 27.6, 19.8 and 17.3 percent growth inhibition at 15, 10 and 5 percent concentration (**Table 1** and **Figure 1**). The least growth inhibition were recorded in onion bulb extract 12.2, 11.4 and 11.4 and followed by citrus leaf extract 13.5, 12.6 and 12.6 at 15, 10 and 5 percent concentration. The average growth inhibition was recorded in Parthenium and Castor leaf extract 26.4 and 17.3 percent at 15 percent concentration. Poor sporulation was only observed in *Allium sativum* 15 percent concentration. The present study was in agreement with the report of Mehta *et al.*, (2010) [7] who also reported that Garlic bulb extract was significantly superior to inhibit the growth of *F. udum*. Singh *et al.*, (2010) [12] also reported highest inhibition of radial growth of *F. udum* by *A. indica* (67.8%) at 5%. Devi and Chhetry, (2012) [2] screened antifungal effect of plant extracts against mycelial growth of *F. udum* at different concentrations of 5%, 10%, 15% and 20%. *A. sativum* at 20% alone recorded 100% inhibition of mycelial growth. In present result also garlic clove extract showed potential in inhibiting the growth of *F. udum*. Shukala and Dwivedi, (2012) [11] garlic extract at 15% inhibited the growth of the *F. udum* (88.26%). Awad (2016) [1] also reported that garlic extracts was most effective for management of sudden wilt of watermelon plants at 1 and 5 percent concentrations.

**Table 1** Effect of plant extracts on radial growth of *Fusarium udum* after six days of incubation

Name of Botanicals	Local name	Parts used	Radial growth of target pathogen (mm)			Mean	Percent Growth inhibition		
			5%	10%	15%		5%	10%	15%
<i>Allium sativum</i>	Garlic	Clove	38.1	33.0	29.3	33.46	51.6	58.2	62.8
<i>Azadirachta indica</i>	Neem	Leaf	64.5	56.6	51.8	57.63	18.3	28.3	34.4
<i>Polyalthia longifolia</i>	Ashok	Leaf	65.3	63.3	57.1	61.90	17.3	19.8	27.6
<i>Parthenium hysterophorus</i>	Parthenium	Leaf	68.6	65.0	58.1	63.90	13.0	17.7	26.4
<i>Ricinus communis</i>	Castor	Leaf	68.8	65.3	65.3	66.47	12.8	17.3	17.3
<i>Citrus limon</i>	Citrus	Leaf	69.0	69.0	68.3	68.76	12.6	12.6	13.5
<i>Allium cepa</i>	Onion	Bulb	70.0	70.0	69.3	69.76	11.4	11.4	12.2
Control			79.0	79.0	79.0				
CD (0.05)			1.643	1.788	1.899				

\*Average of 3 replications



**Figure 1** Evaluation of antifungal activities of plant extracts at 15% concentration on radial growth of *Fusarium udum* after six days of incubation

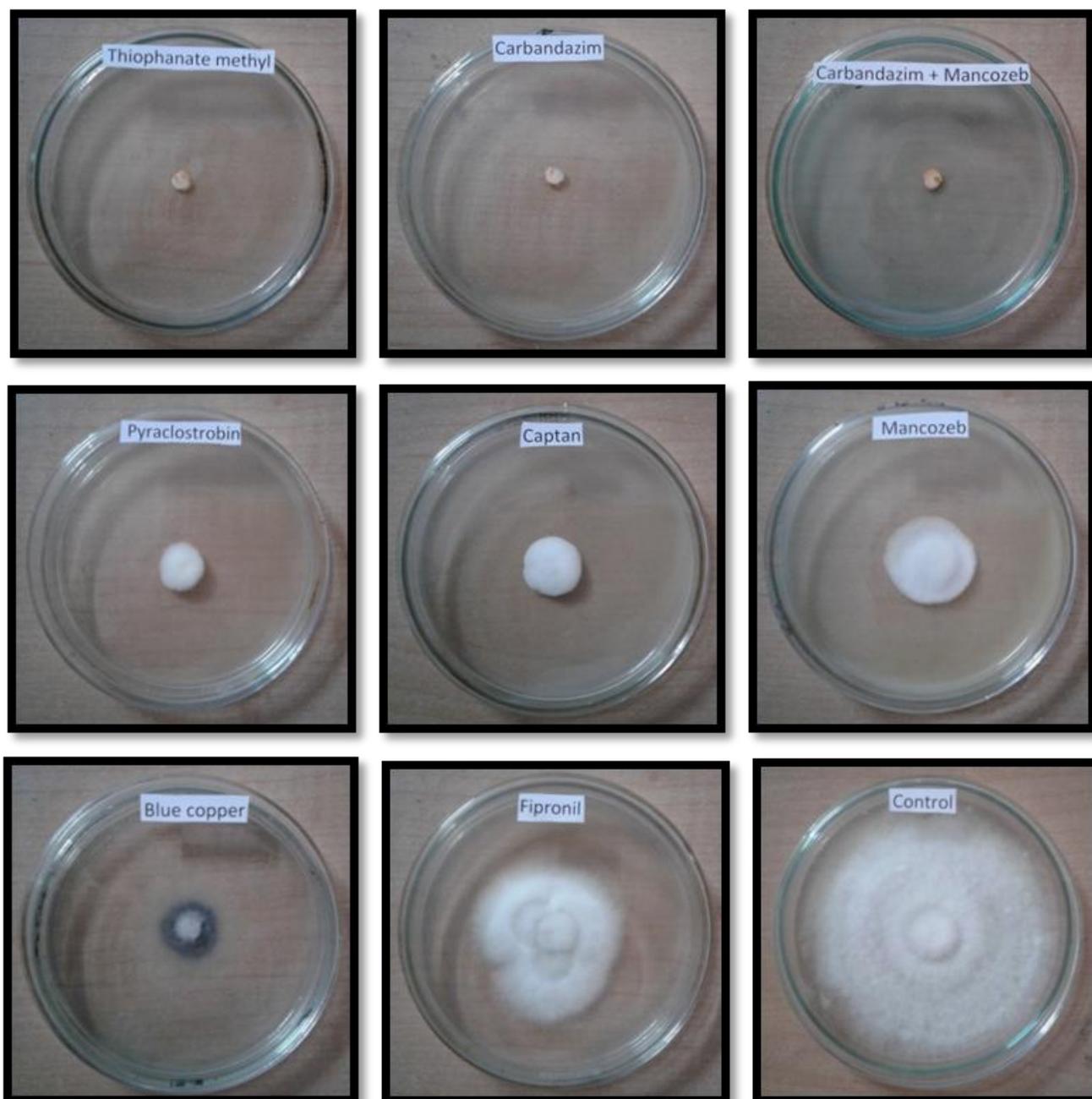
### *Efficacy of fungicides*

Thiophanate Methyl, Carbendazim and Carbendazim + Mancozeb were found best fungicides which completely inhibited the radial growth and sporulation of *F. udum* after 168 hrs of incubation (**Table 2** and **Figure 2**). Pyraclostrobin, Captan, Mancozeb and Blue copper were second next in order of toxicity resulting, respectively 87.18, 81.90, 70.02 and 58.70 percent inhibition of radial growth. Least inhibition was observed in Fipronil (38.97%). Shah *et al.*, (2006) [10] reported that Mancozeb showed maximum inhibition of *F. udum* as compared to other fungicides. In present study, Mancozeb inhibited growth of *F. udum* by 70.0 percent. Raju *et al.*, (2008) [8] evaluated Carbendazim, Captan, Dithane Z-78, Thiophanate-Methyl and Thiram against *F. udum* under *in vitro* and found that Carbendazim completely inhibited the growth of the pathogen at all concentrations (100, 250 and 500 ppm). Sangeetha and Jahagirdar (2013) [9] reported that Carbendazim + Mancozeb (0.2%) was most effective in inhibiting the radial growth of *Fusarium* spp. in soybean. Khadse *et al.*, (2015) [4] also reported that Carbendazim (0.1%) and combination of Carbendazim + Mancozeb (0.2%) exhibited cent percent inhibition of *F. udum*. Carbendazim and Carbendazim + mancozeb also exhibited cent percent inhibition of *F. udum* in present study.

**Table 2** Effect of fungicides on radial growth of *Fusarium udum*

Fungicides	Doses (per 100 ml)	Radial growth (mm) after 168 hrs*	Sporulation	Growth inhibition over check
Thiophanate Methyl	0.1 g	0.0	-	100.0
Carbendazim	0.1 g	0.0	-	100.0
Carbendazim + Mancozeb	0.25 g	0.0	-	100.0
Pyraclostrobin	0.02 g	10.36	+	87.18
Captan	0.25 g	14.63	+	81.90
Mancozeb	0.25 g	24.23	++	70.02
Blue copper	0.3 g	33.38	+++	58.70
Fipronil	0.1 ml	49.33	+++	38.97
Control	--	80.83	++++	
CD (0.05)	1.705			

\*Average of 3 replications

**Figure 2** Effect of fungicides on radial growth of *Fusarium udum*

## References

- [1] Awad HM. 2016. Evaluation of Plant Extracts and Essential Oils for the Control of Sudden Wilt Disease of Watermelon Plants. *International Journal of Current Microbiology and Applied Sciences*. 5(5): 949-962.
- [2] Devi TR and Chhetry GKN. 2012. Evaluation of antifungal activities of certain plant against *Fusarium udum* Butler causing wilt in pigeonpea (*Cajanus cajan* (L.) Millsp.). *International Journal of Scientific and Research Publications* 2(6): 1-4.
- [3] Kannaiyan J and Nene YL. 1981. Influence of wilt at different growth stages on yield loss in pigeonpea. *Tropical Pest Management* 27: 14.
- [4] Khadse RR, Giri GK, Raut SA and Bhoje BB. 2015. In vitro efficacy of fungicides and bioagents against wilt of pigeonpea caused by *Neocosmospora vasinfecta*. *Science International* 3(3): 82-84.
- [5] Khune R. 1990. Biological control of soil borne plant pathogens. *Indian Journal of Mycology and Plant Pathology*. 17: 1-9.
- [6] Leslie JF and Summerell BA. 2006. *The Fusarium, Laboratory Manual*, Blackwell Publishing, pp. 1 – 388.
- [7] Mehta AN, Chauhan HL, Makwara KV, Ghel NM, Patel SL. 2010. Bio efficacy of phytoextract, antagonist and fungicides against *F. udum* incident of pigeon pea wilt. *Journal of Plant Disease Science*. 5(1): 56-60.
- [8] Raju GP, Rao SVR and Gopal K. 2008. In vitro evaluation of antagonists and fungicides against the red gram wilt pathogen *Fusarium oxysporum* f. sp. *udam* (Butler) Snyder and Hansen. *Legume Res.*, 31 (2): 133–135.
- [9] Sangeetha TV and Jahagirdar S. 2013. Screening fungicides against *Sclerotium rolfsii*, *Rhizoctonia bataticola*, and *Fusarium* spp. causing root rot and wilt of soybean. *Bioinfolet.*, 10(1A): 38-41.
- [10] Shah MI, Sultan P, Nasier A, Williams P, Jan A, Sajad M, Rehman S and Shawl AS. 2006. In vitro study on effect of some fungicides viz., Carbendazim, Mancozeb, Conjoint Carbendazim Mancozeb and Sulphur against *F. oxysporum*. *Research Journal of Microbiology* 1: 360-365.
- [11] Shukla A and Dwivedi SK. 2012. Bioefficacy of plant extracts against *Fusarium* species causing wilt in pulses. *IOSR Journal of Engineering* 2(1): 136-144.
- [12] Singh PK, Khan A, Gogoi R and Jaiswal RK. 2010. Plant leaf extracts and bioagents for eco-friendly management of wilt of pigeonpea caused by *Fusarium udum*. *Indian Phytopathology* 63(3): 343 – 344.
- [13] Vincent JM. 1947. Distortion of fungal hyphae in presence of certain inhibitors. *Nature*, 154: 850.

© 2019, by the Authors. The articles published from this journal are distributed to the public under “**Creative Commons Attribution License**” (<http://creativecommons.org/licenses/by/3.0/>). Therefore, upon proper citation of the original work, all the articles can be used without any restriction or can be distributed in any medium in any form. For more information visit [www.chesci.com](http://www.chesci.com).

## Publication History

Received	11.08.2019
Revised	22.12.2019
Accepted	26.12.2019
Online	30.12.2019