



## Additional weed hosts of *Ralstonia solanacearum* recorded in West Bengal

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### ABSTRACT

Ten weeds/wild plants belonging to six families, viz. *Martynia annua*, *Cleome viscosa*, *Physalis minima*, *Cestrum diurnum*, *Amaranthus spinosus*, *Costus speciosus*, *Croton sparsiflorus*, *Datura metel*, *Solanum indicum* and *Solanum sisymbriifolium* were recorded as the host plants of *Ralstonia solanacearum* from Sundarban region of West Bengal, India. Among them, *Martynia annua* and *Cleome viscosa* were recorded first time from India. These weed hosts enable the survival of the bacterial pathogen in absence of crop hosts, and play a significant role in widespread incidence of bacterial wilt of cultivated vegetable crops in West Bengal.

The bacterium, *Ralstonia solanacearum* (Smith) Yabuuchi *et al.* infects many economically important crop plants and a number of weeds. More than 200 plant species of 55 families were reported as hosts of this bacterium (Kelman 1953, Hayward 1994). Weed/wild hosts of the bacterium were reported from different parts of the world and they increase its survival potential in the nature. Some of the weed hosts of the pathogen were reported from India (Chaudhuri and Khatua 1982, Samaddar *et al.* 1998, Mondal 2004). The survival of the bacterium in weed/wild hosts may be one of the reasons for the devastation of this disease in West Bengal. Hence, studies were undertaken to identify weed/wild hosts from different parts of Sundarban region of West Bengal.

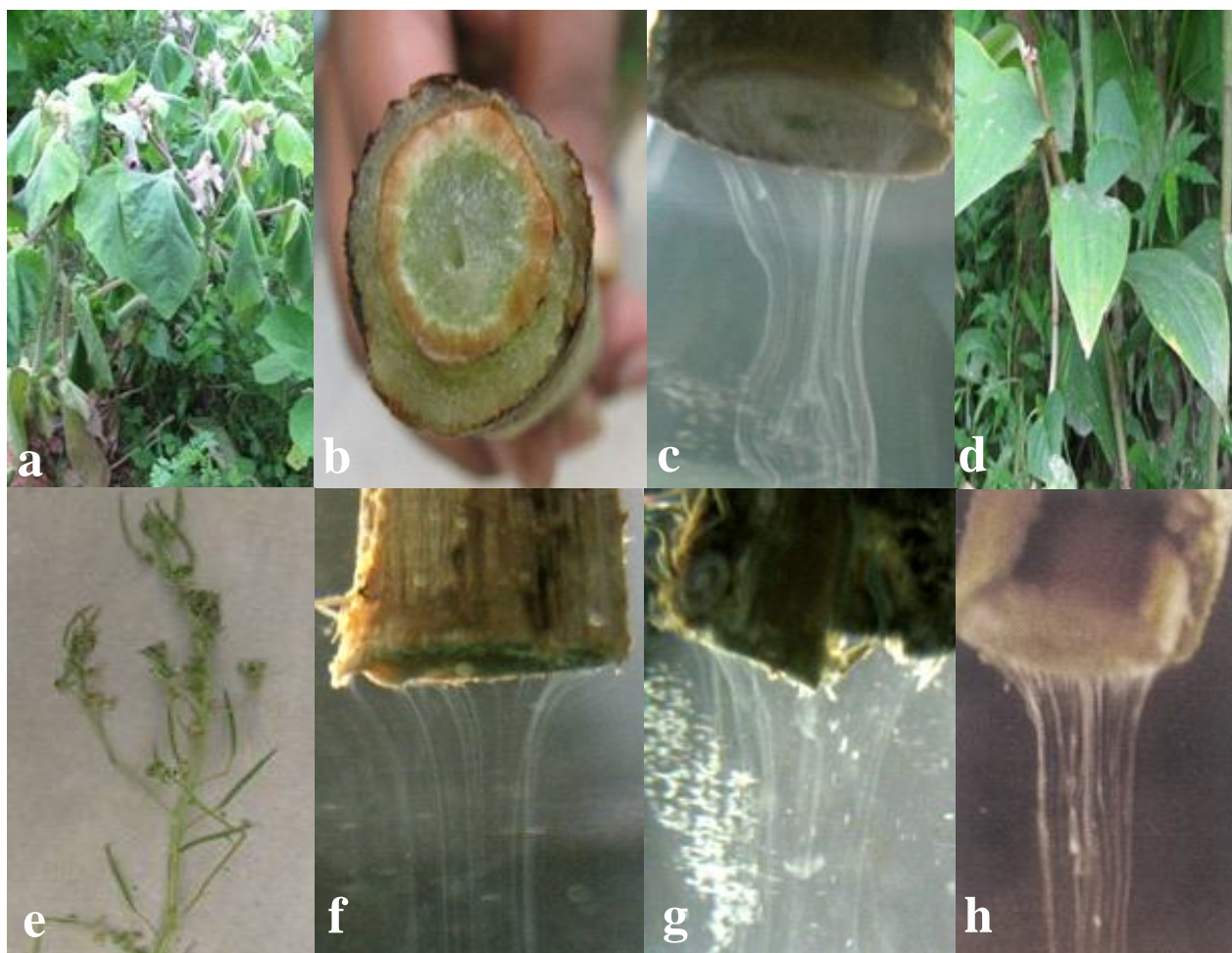
Surveys were conducted in 13 different blocks of South 24 Parganas (Sagar, Namkhana, Kakdwip, Patharpratima, Kultali, Mathurapur-I, Mathurapur-II, Jaynagar-I, Jaynagar-II, Canning-I, Canning-II, Basanti and Gosaba) and six different blocks of North 24 Parganas (Hingalganj, Hasnabad, Haroa, Sandeshkhali-I, Sandeshkhali-II and Minakhan) under Sundarban region of West Bengal (India) for three consecutive years (2012-2014) to record the incidence of bacterial wilt on wild plants or weeds. Incidence of the disease on weeds or wild plants in and around crop fields, barren lands, road side *etc.* was recorded during every month. In this survey, bacterial nature of the disease was confirmed directly

by ooze test in the field condition, and through isolation in selective medium (Granada and Sequeira 1983, Kelman 1954), morphological and biochemical studies in laboratory condition and also through pathogenicity test by stem injection and root inoculation method (Kelman 1953, Kelman 1954, Hayward 1964).

### Weed hosts of the pathogen

During survey, several weeds/wild plants were recorded as the hosts of this bacterium, presented in **Table 1**. In the present study, wilting of ten weeds/wild plants was observed. These were *M. annua* (**Plate 1a, 1b, 1c**), *C. viscosa* (**Plate 1e and 1f**), *P. minima* (**Plate 1h**), *C. diurnum* (**Plate 1g**), *A. spinosus*, *C. sparsiflorus*, *Solanum indicum*, *S. sisymbriifolium*, *C. Speciosus* (**Plate 1d**) and *D. metel* grown abundantly on the roadside, barren and fallow lands, ridges of the field, and in an around the fruit orchards and vegetable fields. Except *M. annua* and *C. viscosa*, all other eight weeds reported earlier as the hosts of this destructive plant pathogen (Mondal *et al.* 2014). The most predominant weeds in brinjal fields and surrounding area were *A. spinosus* and *P. minima*.

*C. diurnum* and *C. speciosus* were found to grow widely in road side, barren and fallow lands and in an around the fruit orchard in some areas of North 24 Parganas and South 24 Parganas district. Some cultivars of *C. diurnum* used as ornamental plant and



**Plate 1. Bacterial wilt of different weeds**

**a:** Bacterial wilt of *Martynia annua*; **b:** Cross section of *Martynia annua* showing vascular browning; **c:** Bacteria oozing out from the cut end of *Martynia annua*; **d:** Bacterial wilt of *Costus speciosus*; **e:** Bacterial wilt of *Cleome viscosa*; **f:** Bacteria oozing out from the cut end of *Cleome viscosa*; **g:** Bacteria oozing out from the cut end of *Cestrum diurnum*; **h:** Bacteria oozing out from the cut end of *Physalis minima*

*C. speciosus* as medicinal plants. According to Mondal *et al.* (2014), *R. solanacearum* survives on *C. speciosus* and *C. diurnum* throughout the season in latent form or in infectious stage. The weeds like *A. spinosus* and *D. metel* were also recorded inside the orchard as latent hosts. Besides, *A. spinosus* grown widely near the rail line (Hasnabad, Canning, Jaynagar railway station) carried this destructive bacterial plant pathogen also. Not only that, *C. sparsiflorus* grown on barren or fallow land and road side acted as reservoir of the bacterium. Mondal *et al.* (2012) recorded the trend of survival strategy of *R. solanacearum* on different hosts from West Bengal. In case of wild hosts the bacterial pathogen survives possibly all over the year which is a major threat for vegetable cultivation.

High temperature along with rainfall favours the bacterial wilt of weeds/wild plants. In majority of the cases, wilting process started from the last week of June (Av. Tmax. 34°C and Tmin. 22°C). The

maximum wilt intensity was recorded during August-September (Av. Tmax. 32°C and Tmin. 25°C) and death of such plants ceased at the end of October (Av. Tmax. 28°C and Tmin. 22°C) or first week of November (Av. Tmax. 27°C and Tmin. 18°C). Natural infection of such widely grown common weeds/wild plants helped in survival of the bacterial pathogen in absence or presence of main hosts, and for inoculum build up. The active inoculum from weed hosts during July-August could easily be transported to nearby fields through rain and irrigation water run-off that initiate disease in crop plants. The findings were in conformation with the earlier reports (Mondal *et al.* 2014).

#### Pathogenicity study

In the present study, bacterial wilt disease was recorded on ten wild plants. Among them, nine isolates were pathogenic on brinjal, tomato, potato and chilli indicating race-1 and one isolate from *C.*

**Table 1. Weeds/wild plants infested by bacterial wilt in West Bengal**

Vernacular name	Scientific name	Family	Location
Bug Noki	<i>Martynia annua</i> L.	Martyniaceae	Jaynagar I & II
Hurhure	<i>Cleome viscosa</i> L.	Cleomaceae	
Bantepari	<i>Physalis minima</i> L.	Solanaceae	Gosaba, Basanti, Sandeshkhali II, Jaynagar I & II
Hasnuhana	<i>Cestrum diurnum</i> L.	Solanaceae	Jaynagar I & II,
Kanta Note	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Hasnabad, Canning I, Jaynagar
Costus	<i>Costus speciosus</i> (Koen ex. Retz.) Sm.	Zingiberaceae	Basanti, Gosaba, Hingalganj
Bonmarich	<i>Croton sparsiflorus</i> Morong.	Euphorbiaceae	All the 19 blocks under Sundarban region
Dhutura	<i>Datura metel</i> L.	Solanaceae	Gosaba, Jaynagar I, Kultali,
Sticky Nightshade	<i>Solanum sisymbriifolium</i> Lam.	Solanaceae	Gosaba, Namkhana, Sandeshkhali I, Hasnabad
Brihoti	<i>Solanum indicum</i> L.	Solanaceae	Canning I & II, Basanti, Gosaba

**Table 2. Pathogenicity of isolates of *R. solanacearum* from weeds/wild plants**

Sources of isolates	Stem injection and root inoculation method				
	Response of pathogenicity test				
	Brinjal	Tomato	Potato	Chilli	Ginger
<i>Martynia annua</i>	++	++	++	++	-
<i>Cleome viscosa</i>	++	++	+	++	-
<i>Physalis minima</i>	++	++	+	++	-
<i>Cestrum diurnum</i>	+++	+++	++	++	-
<i>Amaranthus spinosus</i>	+++	+++	++	++	-
<i>Costus speciosus</i>	-	-	-	-	+
<i>Croton sparsiflorus</i>	++	++	+	++	-
<i>Datura metel</i>	++	++	+	++	-
<i>Solanum sisymbriifolium</i>	++	++	+	++	-
<i>Solanum indicum</i>	++	++	+	++	-

+ + + = Very rapid wilting, + + = Rapid wilting, + = Moderate wilting, - = No wilting

*Speciosus* was on ginger only indicating race-4 of the pathogen. The isolates were dissimilar by means of both host specificity and extent of wilting (Table 2). Highly virulent isolates of *R. solanacearum* from *C. diurnum* and *A. spinosus* developed symptoms rapidly on brinjal and tomato. Existence of variation among isolates of the bacterium infecting different crops or wild plants is known (Buddenhagen *et al.* 1962, Lozano and Sequeira 1970, Kam and Quimio 1977, He *et al.* 1983, Hayward 1994).

Bacterial wilt is a most destructive important vascular disease throughout the world for its wide host range and soil borne in nature. The weeds/wild plants recorded in the present study not only harboured the pathogen in off-season, but also acted as collateral hosts, which appeared to play a significant role in widespread incidence of bacterial wilt of cultivated vegetable crops in West Bengal. Bacteria ooze out from such plants and the active inoculum could easily be transported to nearby other crop fields. So, identification of weeds/wild hosts in and around the crop fields during crop season or off season followed by proper destruction is important for future planning of crop cultivation.

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