A short-term study on Dengue *vis-a-vis* water sources in some districts of Rajasthan, India

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Abstract - It is believed that 50 to 100 million people worldwide in a year suffer from dengue (WHO, 2001). The incidence of dengue has increased 30 fold between 1960 and 2010. It is transmitted mainly by *Aedes aegypti* mosquito and by *Ae. albopictus*. After adult mosquitoes emerge, male mosquitoes feed on nectar from flowers and female mosquitoes feed on human and animals for blood to produce eggs. After feeding, female mosquitoes will look for water sources to lay more eggs. The present study was therefore undertaken to document the dengue cases in relation to water sources/ breeding sites and establish any relationship between these two, in some districts of Rajasthan, India. During the present survey, locations demarcated included water points for animal drinking purpose, storage tanks, coolers, agricultural water logging and any other. Of the total dengue cases, animal water points were found to be significant contributing factor at Bikaner, while, in Sriganganagar and Hanumangarh district agricultural water logging areas were noted to be responsible for more dengue fever cases.
Keywords – Dengue, Bikaner, Rajasthan.

I. Introduction

It is believed that 50 to 100 million people worldwide in a year suffer from dengue (WHO, 2001). The mortality is 1-5% without treatment and less than 1% with treatment. Severe disease (Dengue Haemorrhagic Fever)(dengue shock syndrome) carry a mortality of 26%. The incidence of dengue has increased 30 fold between 1960 and 2010. Dengue causes severe disease in babies and children more so in healthy babies. Women are at high risk than man. The marked spread of dengue during and after the II World Warhas been attributed to ecologic disturbances. It is transmitted mainly by*Aedes aegypti* mosquito and also by *Ae. albopictus*.After adult mosquitoes emerge, male mosquitoes feed on nectar from flowers and female mosquitoes feed on human and animals for blood to produce eggs. After feeding, female mosquitoes will look for water sources to lay more eggs. *Aedesaegypti* only flies a few blocks during its life. Unlike other mosquito species, *Ae.aegypti* mosquitoes prefer to bite people. *Ae.aegypti* mosquitoes prefer to live near people. They can be found inside homes,

buildings, where window and door screens are not used or doors are left propped open.The mosquito breeds usually during rains or in any water logged containers. *Aedesalbopictus* has been considered as a viable vector of dengue viruses in India (Rao, 1964).

Although dengue has been modifiable in India since 1996, the disease's impact has been underestimated because of insufficient information on incidence and cost of dengue illness (Halasa et al., 2011). Between 2006 and 2012 the National Vector Borne Disease Control Program reported an annual average (SD) of 20,474 ($\pm$ 13,760) dengue cases and 132 ($\pm$ 57) deaths caused by dengue (http://www.nvbdcp.gov.in/den-cd.html). Regional comparisons suggest that these official numbers reflect only a small fraction of the full impact of the disease (Kakkar,2012; Shepard et al., 2013; Undurraga et al., 2013). Estimates of the average annual number of cases vary widely from the 20,474 officially reported cases to an annual 33 million apparent cases (Bhatt et al., 2013).

Understanding the economic and disease burden of dengue in India is essential to assist policy makers and public health managers to prepare for and control outbreaks and encourage international collaboration to develop and evaluate prevention, control and management measures, and technologies to control further epidemics (Kakkar, 2012; Chakravati et al., 2012).The present study was therefore undertaken to document the dengue incidence in relation to water sources/breeding sites of the vector *Aedes* sp. in some districts of Rajasthan, India.

II.   The Study area

The present survey pertaining to dengue fever and water sources/breeding sites was carried out in three districts of North West Rajasthan viz. Bikaner, Sriganganagar, and Hanumangarh.

Bikaner district

Bikaner lies between $27^0 11'$ & $29^0 3'$ North and $71^0 54'$ & $74^0 12'$ East covering an area of 2744 sq. Km^2. The district comprises of 926 villages with 8 Tehsils, Panchayat Samities, 4 towns and 4 municipalities. The places/areas surveyed in this district included Bikaner city, Deshnoke, Nokha city, Nokha rural, Dungargarh and Kolayat.

Sriganganagar district

Sriganganagar lies between $28^0 4'$ & $30^0 6'$ North and $72^0 2'$ & $75^0 3'$ East covering an area of 11,15466 km^2. The district comprises of 9 Tehsils and 18 town and small villages, 8 Panchayat Samities. The places/areas surveyed in this district included Sriganganagar city, Suratgarh, Padampur, Sadulshahar, Keshrisinghpur.

Hanumangarh district

Hanumangarh lies in the extreme north of Rajasthan covering an area of 12,645 km^2. The district comprises of 7 Tehsils, 1907 villages, 7 Panchayat Samities. The places/areas surveyed in this district included Hanumangarh, Hanumangarh rural, Ravatsar, Pilibanga, Tibbi.

III. Methodology

The data related to dengue was collected from the three districts viz. Bikaner, Sriganganagar and Hanumangarh which were surveyed for any type of fresh water stagnant water sources in and around the houses like animal water containers, storage water tanks, coolers, agricultural water logging etc. The dengue virus is transmitted though *Aedes* mosquito species. The mosquito breeds in fresh stagnant water and therefore, such water sources/breeding sites become very important.

IV. Observation and Result

The present study was carried out at three districts namely Bikaner, Sriganganagar and Hanumangarh. Based on this survey, water sources acting as breeding sites of vector mosquito species were identified. The vector carrying dengue virus viz.,*Aedesaegypti* breeds in fresh water and therefore logging of such waters becomes a significant source for causing dengue. During the present survey such locations were demarcated which included water points for animal drinking purpose, storage tanks, coolers, agricultural water logging and any other.

Overall, in Bikaner district maximum cases were noted around water points for animal drinking purpose (31%), followed by cooler waters (25%), storage water tanks(25%), agricultural water logging(16%),any other(3%) as presented in Table 1 and Figs.1,2.

In Sriganganagar district, most number of dengue cases were reported in and around agricultural water logging points(22), as presented in Table 2. Besides, good number of cases were also documented in vicinity to cooler water (35%), storage water tanks (34%), water points for animal drinking purpose(4%) and any other (5%) depicted in Figs. 3,4.

From Hanumangarh district most number of dengue cases were observed in an around agricultural water logging followed by drinking water storage points as have been presented in Table 3.Besides, good number of cases were also documented in agriculture water logging 128 (32%) followed by storage water tanks 117 (30%), water containers for animal drinking purpose 86 (22%), coolers 65 (16%) as presented in Figs. 5, 6.

V. Discussion

The result shows that the maximum cases were noted around water points for animal drinking purpose (31%) from Bikaner district. From Sriganganagar and Hanumangarh district most number of dengue cases were reported in and around agricultural water points(22%).

Water holding containers viz., plastic or metal drums and cement tanks facilitate breeding of *Ae.aegypti* (Sharma et al. 2008, Shriram et al. 2009). Owing to water scarcity, inhabitants in desert areas over store domestic water and this water storage habit during summer season has immerged to be the risk factor of dengue vector abundance in urban areas of arid and semi- arid settings. Sharma et al. (2008) have observed cement tanks, coolers and underground tanks to be the most preferred breeding habitats in urban areas. Tsuda et al. (2002) from the study on ecological survey of dengue vector suggested occurrence of *Ae. aegypti* in water jars in one place and drums, small or discarded containers in other place.

Abundant breeding sites and human shelters with plenty of food are some factors which may be responsible for the prevalence of dengue fever in a particular area has been suggested by Dibo et al. (2008).

Kundi et al. (2014) suggested that immature stage or larval stages of *Ae. aegypti* are found in water filled habitats, mostly in artificial containers closely associated with human dwellings and often indoors. *Aedes* mosquito has an ability to adopt to local human habitation with ovi position and larval habitats in natural rock pools, tree holes and leaf axis, water tanks, blocked drums in rural and artificial, pots and food beverages containers, flower pots, water storages jars, cisterns, metal cans, discarded tires and any other fresh water container that people leave outside while living in urban environments (Naish et al.,2014). Heavy rainfall may flush away eggs, larvae and pupae from container in the short term, but residual water can create breeding habitats for longer term (Hii et al., 2012; Naish et al., 2014).

Of the total dengue cases, animal water points were found to be significant contributing factor at Bikaner, while, in Sriganganagar and Hanumangarh district agricultural water logging areas were noted to be responsible for more dengue fever cases.

VI.   References

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Table 1. Total number of dengue cases reported based on vicinity to various water source from Bikaner district (Mar-Nov)

Area / Water sources	Water containers for animal drinking purpose	Storage water tanks	Coolers	Agricultural water logging	Any other	Total
Bikaner district	132	106	109	67	14	428
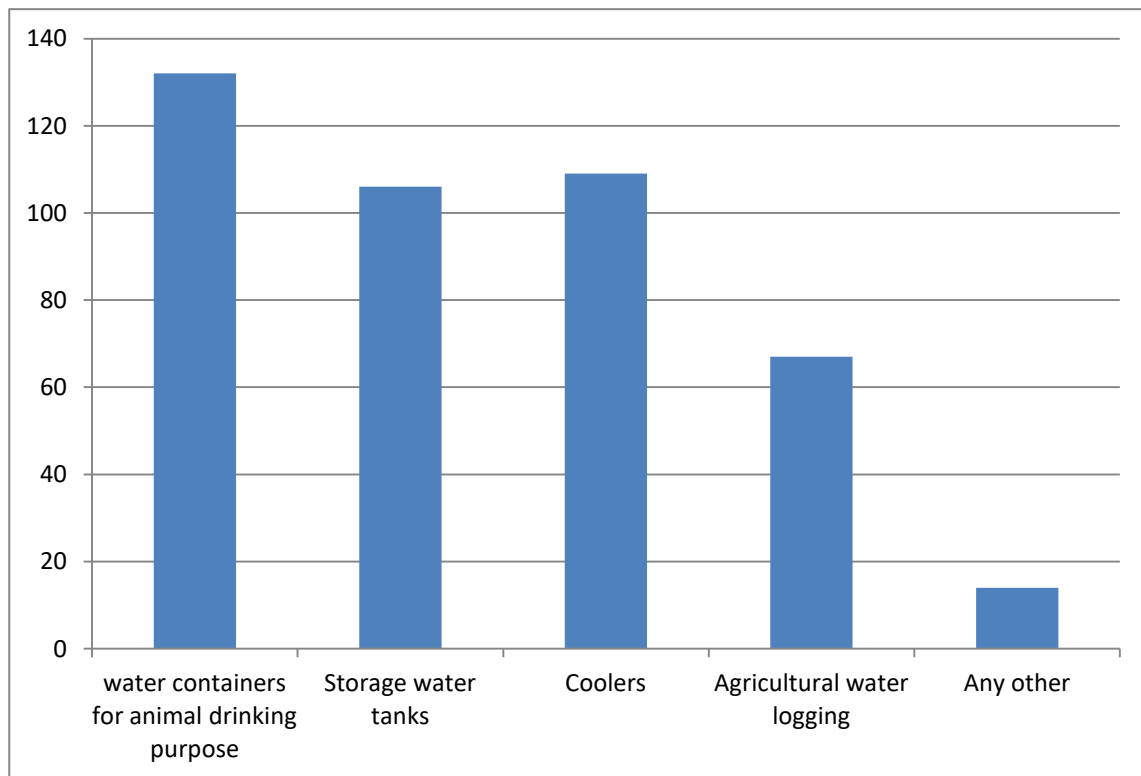
Fig. 1.Dengue cases based on vicinity to various water source from Bikaner district (Mar-Nov)
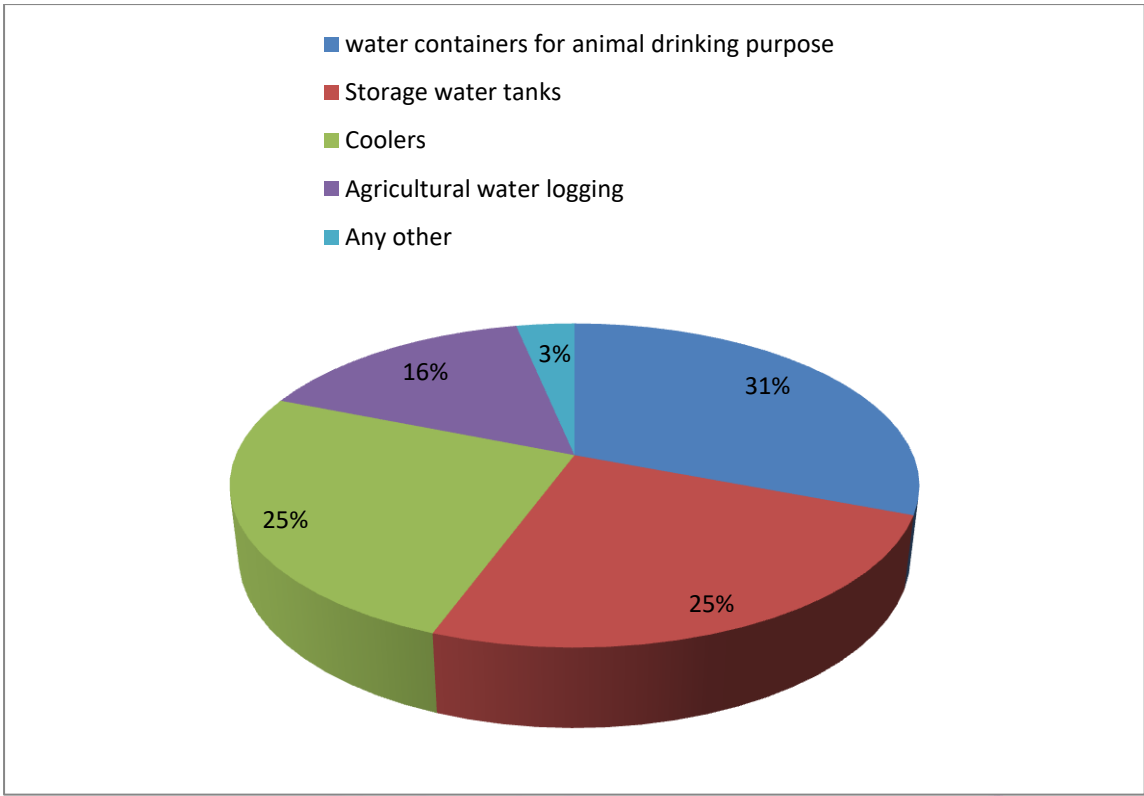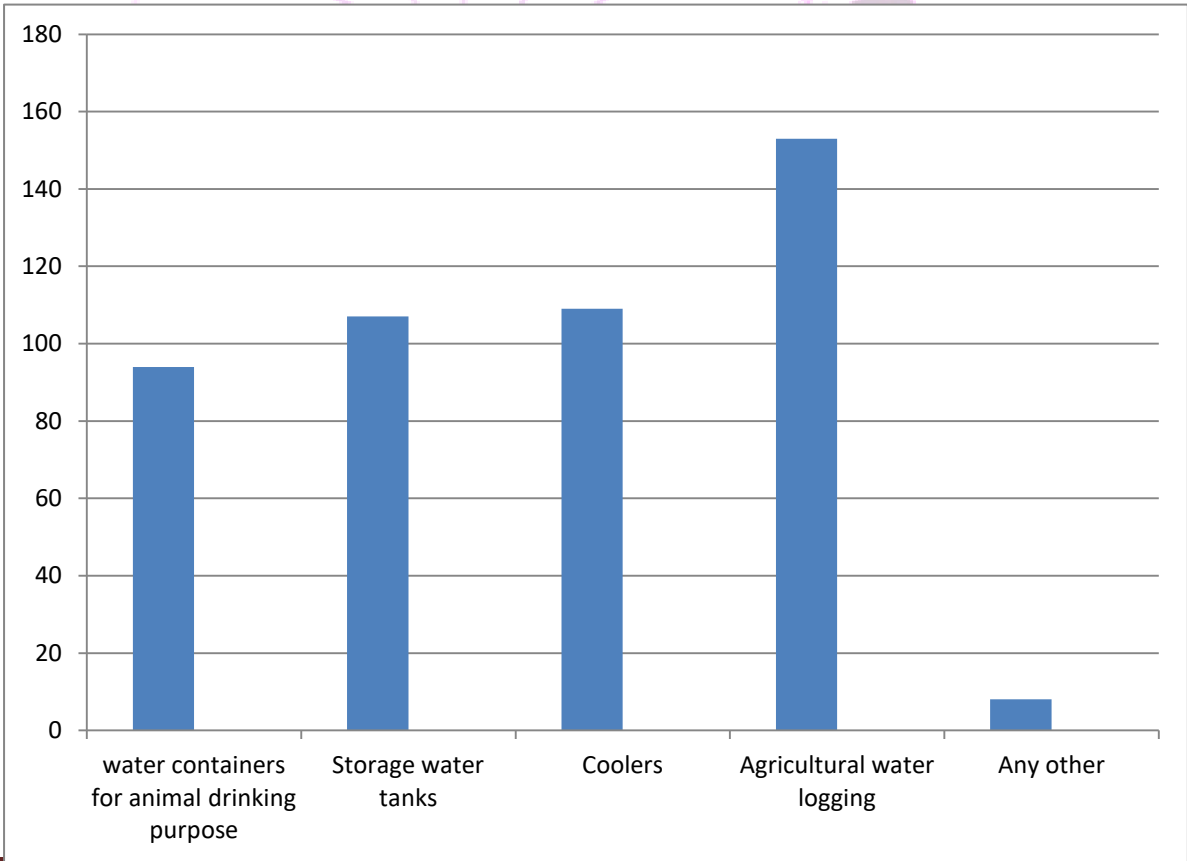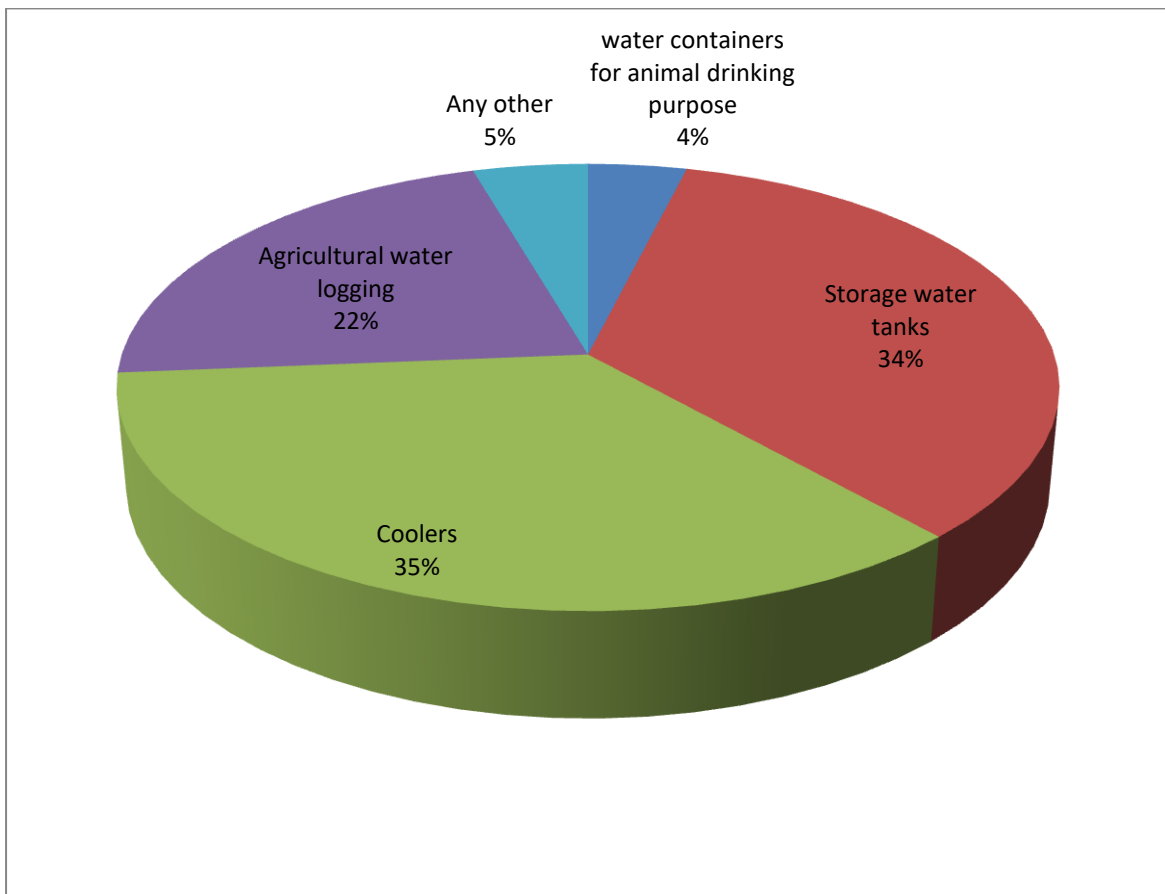
Fig. 2. Per cent dengue cases based on vicinity to water source from Bikaner district (Mar- Nov)

Table 2. Total number ofdengue cases reported based on vicinity to water various sources from Sriganganagar district (Mar- Nov)

Area / Water sources	Water containers for animal drinking purpose	Storage water tanks	Coolers	Agricultural water logging	Any other	Total
Sri ganganagar district	94	107	109	153	8	471

Fig. 3.Distribution of dengue cases based on vicinity to various water source from Sriganganagar district (Mar- Nov)

Fig. 4. Per cent dengue cases based on vicinity to water sources from Sri ganganagar district (Mar-Nov)

Table3. Total number of dengue cases reported based on vicinity to various water sources from Hanumangarh district (Mar- Nov).

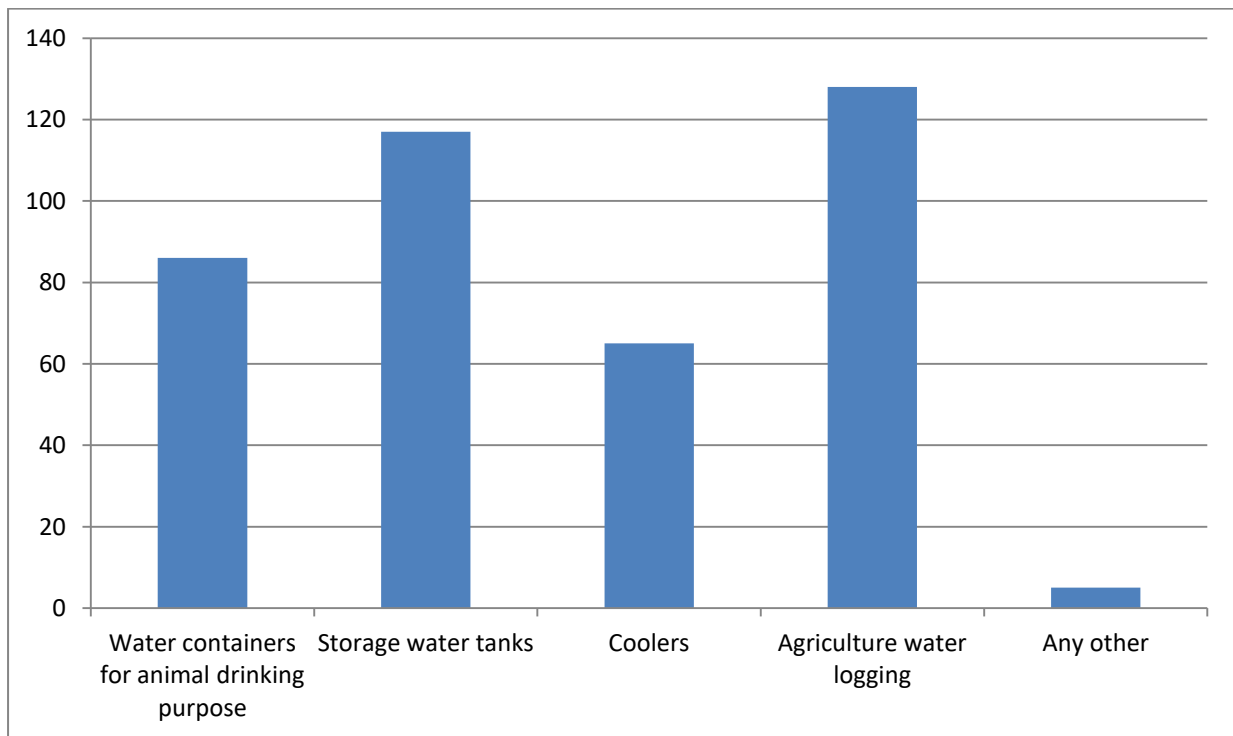| Area \ Water source	Water containers for animal drinking purpose	Storage water tanks	Coolers	Agriculture water logging	Any other	Total
Hanumangarh district	86	117	65	128	5	401

Fig.5.Dengue cases based on vicinity to various water sources from Hanumangarh district(Mar- Nov).
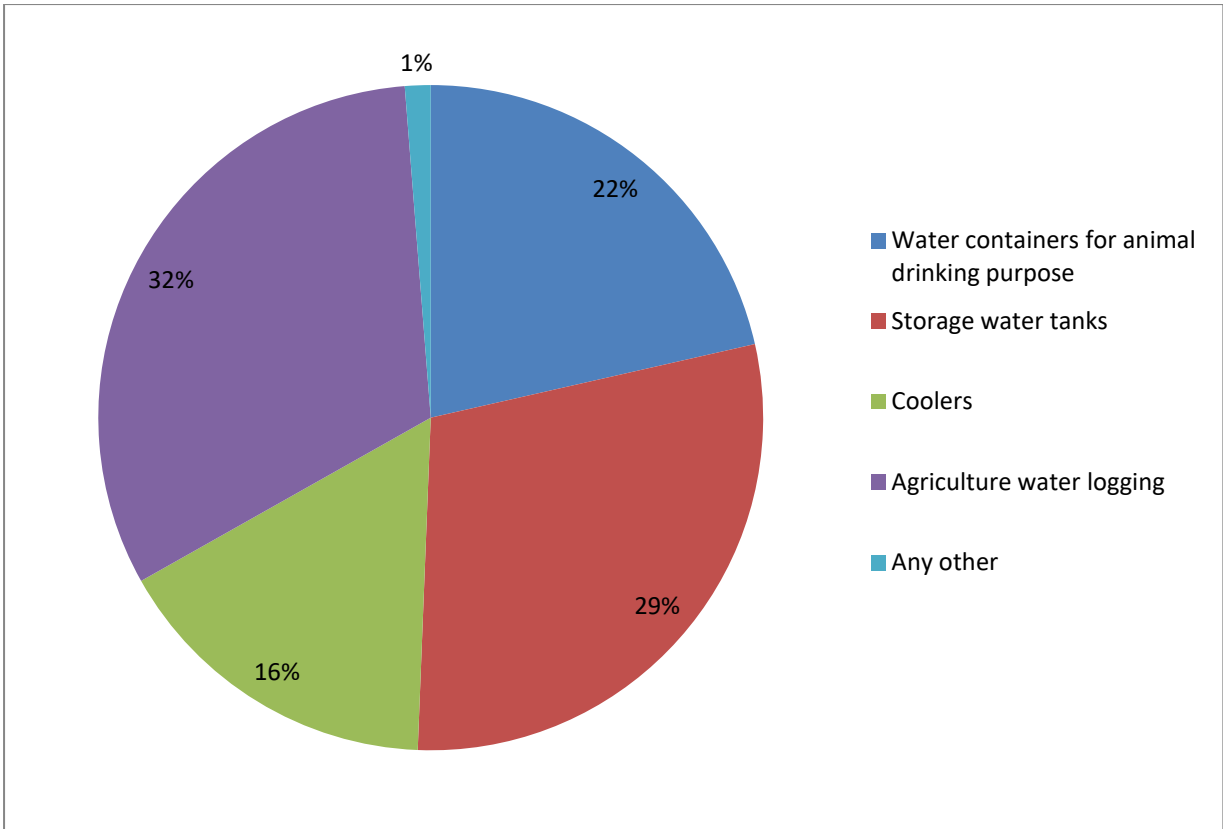
Fig.6. Per cent dengue cases based on vicinity to water sources from Hanumangarh district(Mar- Nov).