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A short term study on Anopheline mosquito population and malaria incidence in Sujangarh Tehsil of Rajasthan, India

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Abstract - The vector ecological studies have to be under taken in order to locate risk areas for malaria and to formulate appropriate vector control strategies and therefore the present work on entomological, incidence and parasitological parameters of malaria in Sujangarh Tehsil (Urban and Rural) of Rajasthan was undertaken. Only two anopheline mosquito species viz. *An. stephensi* and *An. subpictus* were documented from the area surveyed. Both the species were noted intermittently and in equal proportion urban area while, *An. subpictus* was lower in rural area. Further, only Pv +ve cases were recorded from Sujangarh urban, but Pv as well as Pf +ve cases were reckoned from rural area. It could therefore be concluded that number of malaria cases were proportional to number of the anopheline mosquito species.

Keywords: Mosquitoes, Anopheline, rural, urban, Malaria, Pv, Pf.

I. Introduction

The abundance of vector mosquitoes varies with season and availability of habitats. Mobility of human hosts between different regions also influences the transmission process. In this regard assessment of the density and diversity of anopheline mosquitoes in space and time can help to monitor the possibility of malaria in a region apart from formulating the control strategies. Higher vector density with high parity rate, poor socio-economic condition, lack of awareness about malaria, poor sanitation and presence of parasite load in the community make the population more vulnerable for contacting malaria. The transmission and incidence of malaria in a region is characterized by seasonal fluctuations. Magnitude of rain and agricultural patterns are some major factors which determine the breeding of vector, its density and longevity.

Human intervention in the form of new settlement, open pit mining, hydroelectric dams and irrigation projects has altered natural ecosystems and paved the way for the emergence of different malaria vectors and their propagation. The emergence of different species as vector accelerates the momentum of disease transmission.

The vector ecological studies have to be under taken in order to locate risk areas for malaria and to formulate appropriate vector control strategies and therefore the present work on entomological, incidence and parasitological parameters of malaria in Sujangarh Tehsil (Urban and Rural) of Rajasthan was undertaken.

II. Materials and Method

The Study area - Sujangarh Tehsil

Sujangarh Tehsil is a part of the Great Indian Thar desert. It lies in North–Western part of Rajasthan located between 27°11' and 29°03' North latitudes and 71°52' and 74°12' East longitudes. It lies in Churu district of Rajasthan. The total area of the district is 30289 sq. km with a general elevation lying between 154 to 429 m above the mean sea level, sloping towards North–West. Sand dunes range which in height from 6 to 30 m.

The Tehsil has a dry climate with large variation in temperature and has scanty rainfall. Summer months are extremely hot with the day temperature sometime going up to 49°C, June being the hottest month. During winter the minimum temperature sometimes drops up to 2°C below freezing point, January being the coldest month. The average rainfall in the district is 259.6 mm and average relative humidity is of the order of 15 to 20 percent.

For the purpose of the study, the Sujangarh city was considered under the head Sujangarh urban and adjoining villages quoted as Sujangarh rural.

Sujangarh urban

The Sujangarh city is located at 27.7°N, 74.47°E elevation of 312m (1,024ft). It is known for its temples, havelies and forts.

Sujangarh rural

Four places surveyed under this head included Chhaper, Gopalpura, Gogalia and Randhisar. All these four villages are also gram panchayat and are 12 km, 14km, 30km and 27 km away from Sujangarh city respectively.

Survey and periodicity of collection

The survey was carried out over an annual cycle. Samples were collected every week from the selected locations. The adult mosquitoes were collected during dawn and dusk from the field areas and during day hours from covered areas, fodder houses, toilets, bathrooms etc., besides vicinities of different water bodies / breeding sites.

Method of collection of adult mosquitoes

Adult mosquitoes were collected with the help of aspirator tubes and torch light. These were then transferred into collection tubes plugged with cotton and brought live to the laboratory.

Parameters studied

(a) Entomological data

Species composition

The adult mosquitoes collected live from fields were anaesthetized by keeping the tubes in deep freeze for 2–3 minutes and observed under the microscope and identified using standard taxonomic keys. Different anopheline species identified were sorted, counted and expressed as percent composition.

Vector density

The density of mosquitoes was calculated in terms of adults caught and expressed as number (No.) per man hour (pmh).

(b) Malaria incidence and Parasitological data

A ward-wise monthly malaria parasitological data was collected from District CMHO office, Sujangarh regarding *Plasmodium falciparum* / *P. vivax* infection positive cases.

III. Results

Anopheline mosquito species

(i) Diversity

During the present survey only two anopheline mosquito species were documented viz., *An. stephensi* and *An. Subpictus*. Both the species were intermittently reckoned from both the study areas namely Sujangarh urban and Sujangarh rural.

(ii) Density

In Sujangarh (urban) the density of both the anopheline species was noted to be high in the month of August, while none were noted during Jan. to March. The density of *An. subpictus* was a higher as compared to *An. stephensi* in the month of August. Overall, both the species were present in equal proportion in Sujangarh urban area. Nearly a similar trend in density was observed in Sujangarh rural area also, except that the overall density of both the mosquito species was low as compared to urban area. The per cent proportion of *An. subpictus* was lower than *An. stephensi* in rural area, while it was exactly the same in urban area as presented in Figs. 2 & 4. Similarly the population density of the mosquito species collected from the areas under survey has been presented in Tables 1 & 2 and Figs. 1 & 3.

Malaria incidence and parasitological data

In Sujangarh city (urban)

Based on the data obtained from CMHO, it was observed that overall there were 51 cases of Pv +ve patients while no Pf +ve patients were recorded during the period of study. Further, most number of Pv +ve patients were documented in the month of December while, no cases were reported from January to April. The observations have been presented in Tables 3 & 4 and Figs. 4 & 5.

In Sujangarh villages (rural)

From the data obtained with respect to malaria incidence in adjoining villages of Sujangarh city, it was found that although the trend of Pv +ve cases was similar to that of urban, the total number of malaria cases was less in rural area. In addition, a significance difference between the two areas was that from villages Pf +ve cases were also recorded although only once in the month of August.

IV. Discussion

Diversity/ Species composition

During the present survey only two Anopheline mosquito species were documented from the region of survey, viz., *An. stephensi* and *An. subpictus*. The present findings are in conformation with the reports of Joshi *et al.* (2005) who also documented *An. subpictus*, *An. stephensi*, *An. culicifacies* and *An. annularis* from the Thar desert area and Tyagi *et al.* (2001) who recorded *An. stephensi*, *An. culicifacies*, *An. subpictus* and *An. annularis* from the Jaisalmer district of Rajasthan. Earlier according to Tyagi & Yadav (2001), *An. stephensi*, *An. culicifacies* and *An. subpictus* were among the eight anopheline species acting as malaria vectors in north western Rajasthan, while Shukla *et al.* (1995) suggested that malaria transmission in Rajasthan was caused by *An. stephensi*, *An. culicifacies* and *An. fluviatilis* in relays (Kirti & Shipali 2014).

Tyagi & Choudhary (1997) suggested that along with *An. stephensi*, the traditional malaria vector in xeric environment, *An. culicifacies* established itself in the areas extensively irrigated through canals. Most of them restricted to Udaipur zone in Southern Rajasthan while, only seven species were observed desert districts (Christophers, 1933). According to Tyagi (2004), *An. stephensi* was responsible for transmitting malaria at low level in Rajasthan initially, but after initiation of canalized irrigation, several anophelines including *An. culicifacies* have established themselves in the region. Six anopheline species were collected by Bansal & Singh (1993) from Bikaner district which included *An. subpictus* (34.7%), *An. stephensi* (33.3%), *An. culicifacies* (18%), *An. annularis* (12.1%), *An. pulcherrimus* (1.1%) and *An. barbirostris* (0.8%).

Species density

During the present survey, the densities of both the documented species was lower in rural area as compared to urban. Further, the maximum density of Anopheline species in urban area was observed to be higher during August. The present findings are in conformation with the earlier works of Sharma (1995), who also reported the peak adult density of *An. stephensi* and *An. Culicifacies* in the month of August, while Shukla *et al.* (2007) recorded the highest density of *An. culicifacies* during July to September in Uttranchal. Tyagi *et al.* (2001) reported *An. stephensi* to be the dominant species followed by *An. culicifacies*, *An. subpictus* and *An. annularis* from Jaisalmer district. The present findings get support from the work of Herrel *et al.* (2004) who documented *An. subpictus* as a pre-dominant form followed by *An. stephensi* and *An. culicifacies* in irrigated areas of south-Punjab of Pakistan. Further, according to them the three species peaked in during October, August and September respectively, which corroborate the present findings.

According to the reports of Pramanik *et al.* (2006), *An. subpictus* was a dominant species in terms of its abundance in rural as well as urban areas of Kolkata and the post monsoon season was found to be the most favourable followed by monsoon, summer and winter. During the present study also, maximum density of this species was noted during August. Sharma *et al.* (1993) reported *An. culicifacies* and *An.*

stephensi to be prevalent throughout the year in peri-urban areas of Delhi with higher density during the post-monsoon months.

During the present study, which was carried out during an annual cycle, both the species were intermittently documented which gets support from the work of Devi & Jauhari (2006). Nagpal & Kalra (1997) reported *An. culicifacies* to be a major rural vector of malaria while according Kannathasan *et al.* (2008) *An. subpictus* is a well spread vector in Sri Lanka.

Malaria incidence and parasitological data

On the basis of reports collected from the office of CMHO, Sujangarh Tehsil during the period of study it was found that *Pv* malaria prevailed in urban as well as rural area. However, no *Pf* cases were documented from urban area, but these were reported from rural area, although only once in the month of August.

Subbarao *et al.* (1988) observed active transmission of *P. vivax* from May to October and *P. falciparum* from August to December which supports the present findings. According to Madhavan *et al.* (2001), maximum prevalence of malaria in most parts of India is from July to November, which is also in conformation with the present findings wherein the highest reports were in the month of August. Highest malaria positive cases were reported in the months of August and September by Devi & Jauhari (2006). Kochar *et al.* (2007) reported maximum number of malaria cases to occur in post rainy season and least in January and February which also corroborate the present findings.

The peak incidence of malaria in the months of August and September was reported by Sharma & Khanduri (2009). They also reported maximum number of cases were due to *P. vivax* as was also found during the present survey. Tyagi & Yadav (2001) noted malaria prevalence to be higher in IGNP villages as compared to that of unirrigated villages, but with higher proportion of *P. falciparum* in the former villages as compared to the latter.

Dev (1996) observed malaria cases in all the months of a year and a peak during May-June which corresponded with heavy rains in Assam. Highest incidence of *P. falciparum* was also documented during these months by them. High *P. vivax* incidence of 66.7% was recorded in the month of May from Utranchal by Shukla *et al.* (2007). Das *et al.* (2004) also reported 49.1% *P. falciparum* infected cases from villages of Sonitpur district of Assam. According to reports of Sharma *et al.* (1993), *P. vivax* contributed to 48.3% and *P. falciparum* to 51.7% of the positive malaria cases recorded from urban areas of Delhi. Pardal *et al.* (2009) reported 86 to 98% *P. falciparum* infections and the rest of *P. vivax* in Assam.

V. Conclusions

Only two anopheline mosquito species viz. *An. stephensi* and *An. subpictus* were documented from the area surveyed. Both the species were noted intermittently and in equal proportion urban area while, *An. subpictus* was lower in rural area. Further, only *Pv* +ve cases were recorded from Sujangarh urban, but *Pv* as well as *Pf* +ve cases were reckoned from rural area. It could therefore be concluded that number of malaria cases were proportional to number of the anopheline mosquito species.

VI. References

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Table 1.Anopheline mosquito density (no/man h) from Sujangarh (Urban) during the period of survey

S.No.	Month	<i>An. stephensi</i>	<i>An. subpictus</i>
1	Oct.	15	14
2	Nov.	14	18
3	Dec.	12	Nil
4	Jan.	Nil	Nil
5	Feb.	Nil	Nil
6	Mar.	Nil	Nil
7	Apr.	12	15
8	May	16	14
9	Jun.	10	08
10	July	11	14
11	Aug.	21	28
	Total	111	111

Table 2. Anopheline mosquito density (no/man h) from Sujangarh (Rural) during the period of survey

S.No.	Month	<i>An. stephensi</i>	<i>An. subpictus</i>
1	Oct.	14	13
2	Nov.	18	13
3	Dec.	11	12
4	Jan.	Nil	Nil
5	Feb.	Nil	Nil
6	Mar.	Nil	Nil
7	Apr.	3	4
8	May	10	6
9	Jun.	8	6
10	July	7	4
11	Aug.	16	18
	Total	87	76

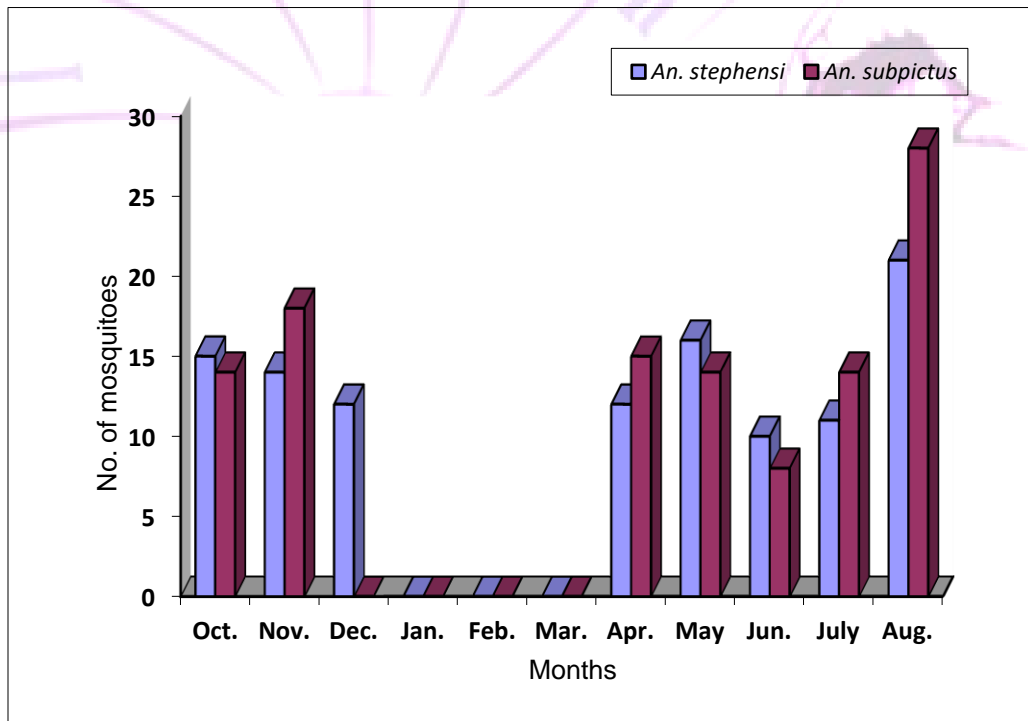


Fig. 1 . Density (no/mh) of Anopheline mosquito species documented from Sujangarh (Urban) during the period of survey

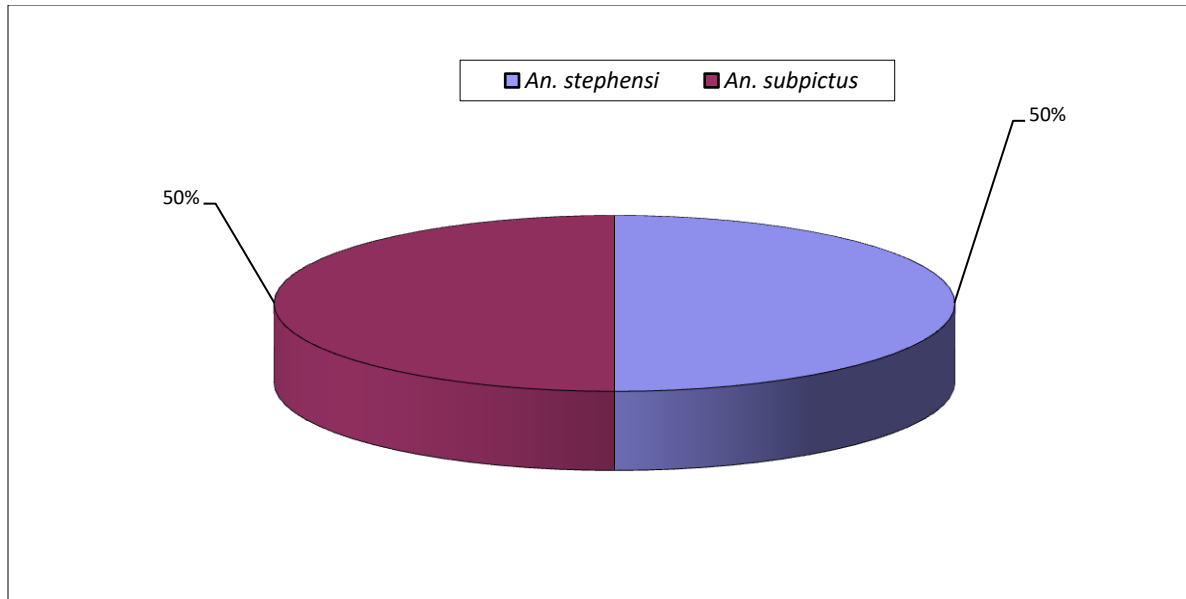


Fig. 2. Per cent distribution of Anopheline mosquito species documented from Sujangarh (Urban) during the period of survey

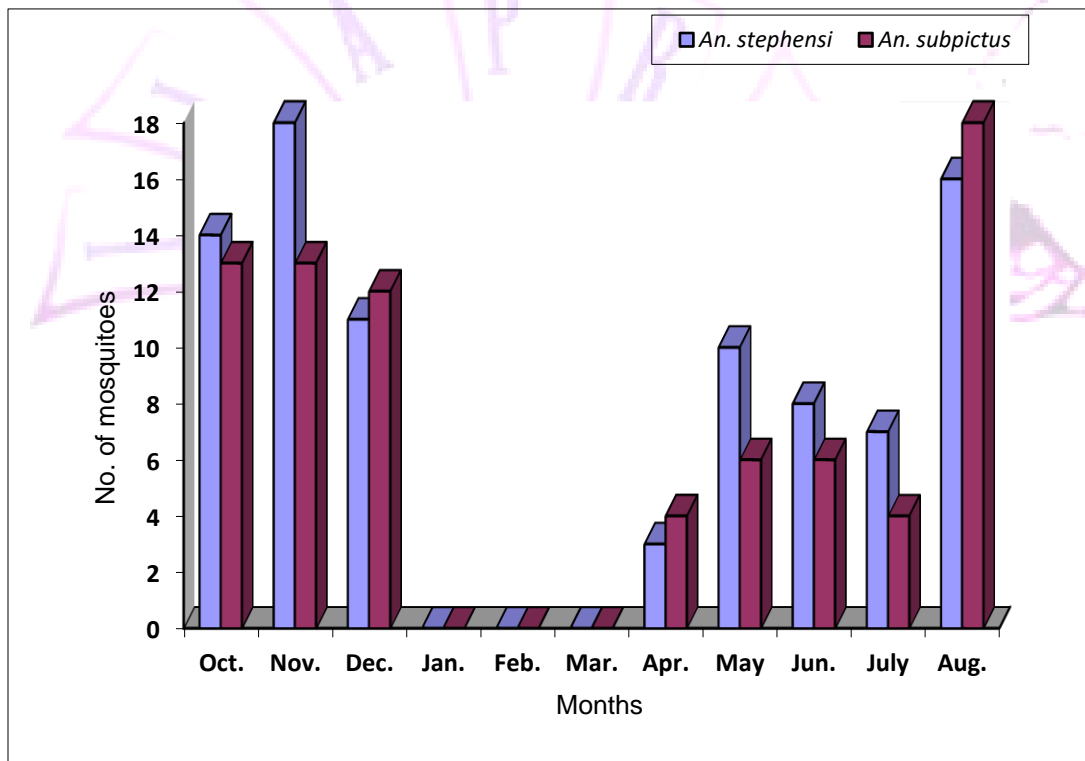


Fig. 3. Density (no/mh) of Anopheline mosquito species documented from Sujangarh (Rural) during the period of survey

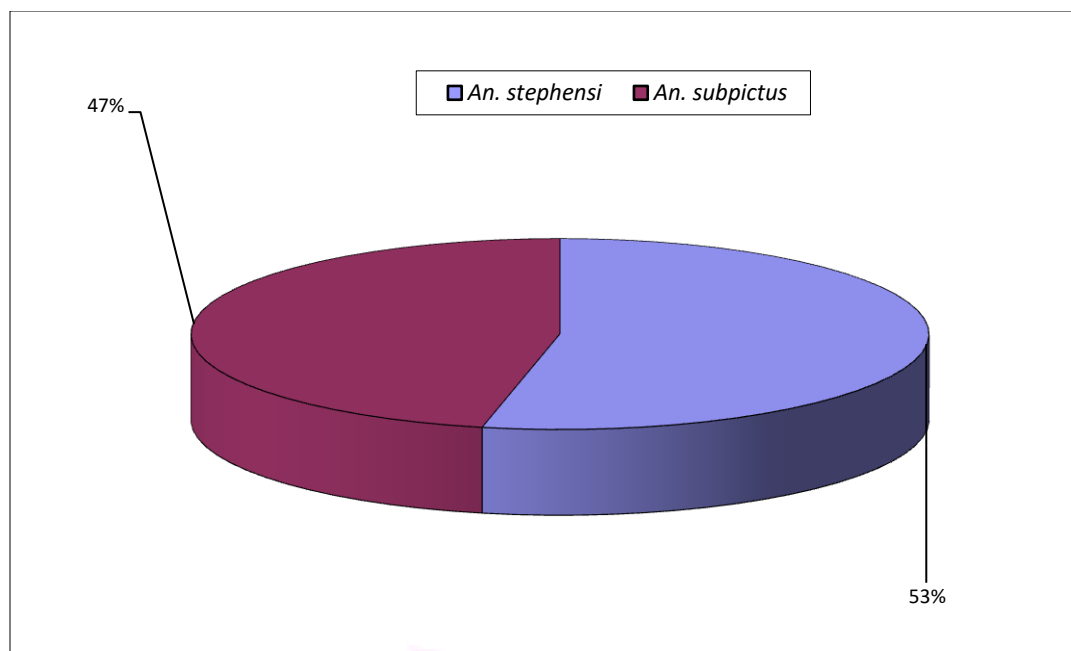


Fig. 4. Per cent distribution of Anopheline mosquito species documented from Sujangarh (Rural) during the period of survey

Table 3. Number of malaria cases reported from Sujangarh (Urban) during the period of survey

S.No.	Month	Pv	Pf
1	Oct.	08	Nil
2	Nov.	06	Nil
3	Dec.	13	Nil
4	Jan.	Nil	Nil
5	Feb.	Nil	Nil
6	Mar.	Nil	Nil
7	Apr.	Nil	Nil
8	May	04	Nil
9	Jun.	07	Nil
10	July	05	Nil
11	Aug.	08	Nil
	Total	51	Nil

Table 4. Number of malaria cases reported from Sujangarh (Rural) during the period of survey

S.No.	Month	Pv	Pf
1	Oct.	06	Nil
2	Nov.	04	Nil
3	Dec.	03	Nil
4	Jan.	Nil	Nil
5	Feb.	Nil	Nil
6	Mar.	Nil	Nil
7	Apr.	Nil	Nil
8	May	02	Nil
9	Jun.	04	Nil
10	July	04	Nil
11	Aug.	06	06
	Total	29	06

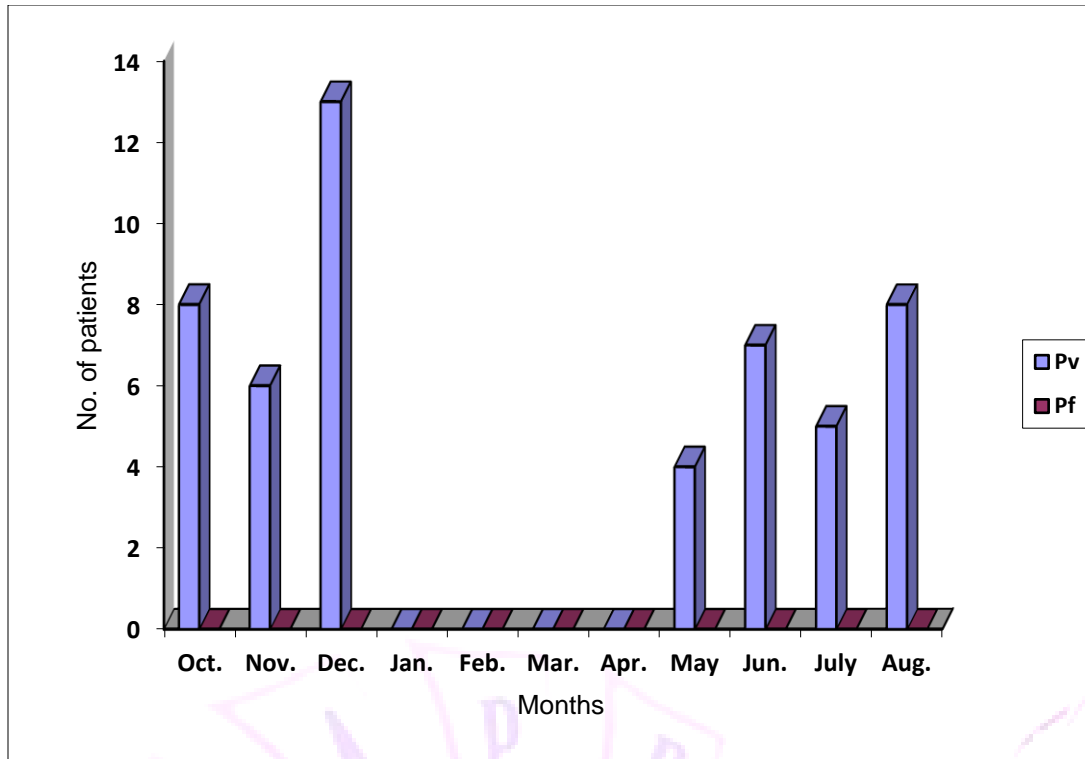


Fig. 5. Number of malaria cases reported from Sujangarh (Urban) during the period of survey

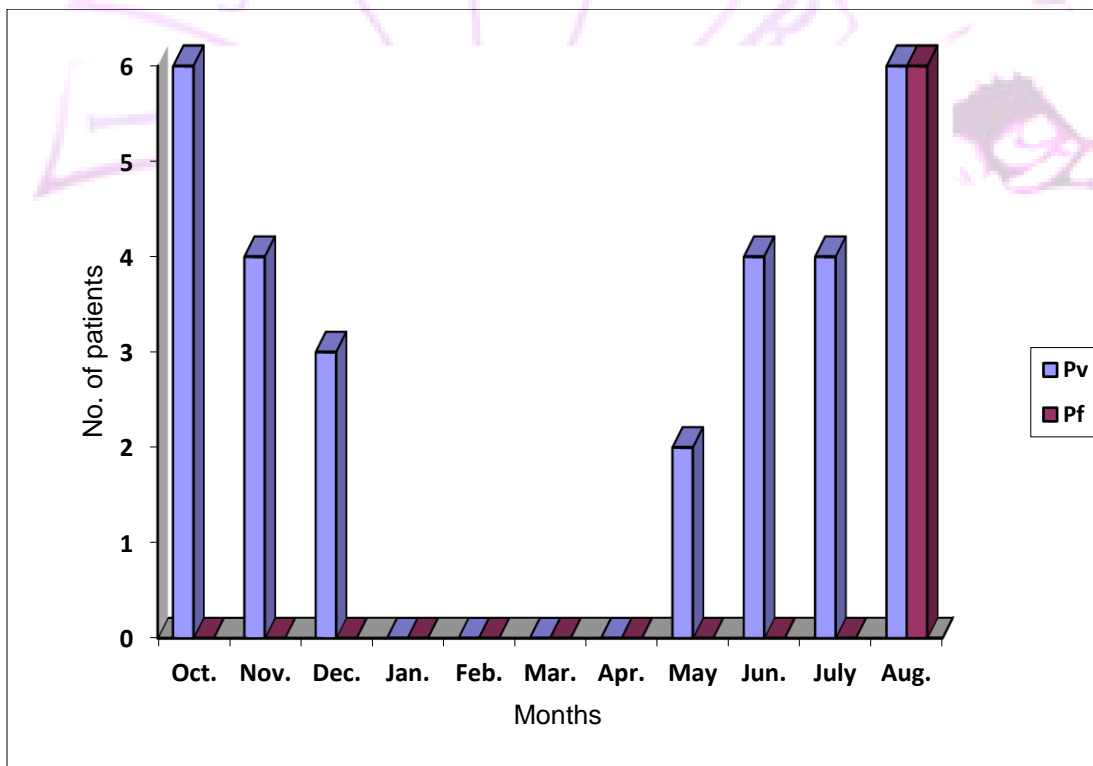


Fig. 6. Number of malaria cases reported from Sujangarh (Rural) during the period of survey