BROOD REARING ACTIVITY OF *Apis cerena* F. IN SOUTH GUJARAT

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ABSTRACT

The studies on the brood rearing activity Apiscerana F. in south Gujarat were made at Navsari Agricultural University, Navsari during March 2003 to April 2005 for the period of two years. For the purpose, three colonies of A. cerana maintained in ISI - 8 type hives were kept in the university campus and observations on colony growth parameter like area under brood (egg, grub and pupa) as well as area under honey and pollen stores were recorded at fortnightly interval. The analysis of pooled data of two years revealed mean area under brood was higher in the second fortnight of January (1262.65 cm^2) which was statistically at par with the second fortnight of January (1221.80 cm^2). With regard to seasonal variation, the winter season proved its superiority by demonstrating significantly higher area under total brood (1082 .06 cm^2) as compared to summer (496.41 cm^2) and monsoon (373.85 cm^2). The data on pollen store indicated that it was significantly higher during first fortnight of February (283.81cm^2), which was at par with second fortnight of January (270.35 cm^2), second fortnight of February (269.83 cm^2) and first fortnight of January (259.08 cm^2). With regards to honey store, second fortnight of February recorded significantly higher mean honey store of 979.72 cm^2, which was at par with first fortnight of February (962.66 cm^2). The overall results indicated that brood rearing activity of A. cerana continuously declined from March onwards, reached minimum in second fortnight of Augus then started increasing and reached to its peak during second fortnight of January.

KEY WORDS: Brood, honey bee, pollen store

INTRODUCTION

Beekeeping is the scientific rearing of honeybees, which primarily provides two fold benefits to man. First it provides honey, which is a rich source of energy and secondly by pollinating the various crops, increasing the yield and quality of the produce. In South Gujarat, all three indigenous bee species *i.e.,Apisdorsata, A. florae* and *A. cerana*as well as stingless bees and solitary bees exist naturally with *A. dorsata* being the predominant one. South Gujarat, particularly the Dang district and eastern part of Valsad, Navsari and Surat district has around 40 per cent area under forest. Apart from this, Valsad district has sizable area under orchards of mango and it is known as heartland of orchards in Gujarat. The increase in irrigation facility in the area further enriched the floral diversity especially with the

horticultural crops even though, as far as beekeeping is concerned, there is practically no beekeeping in the area. Previously, efforts were made by only one of the interested beekeepers during 1995-96 (Rao, 1997). The availability of floral diversity in the area as well as presence of large number of *A. dorsata* colonies in the area induced to take up studies on brood rearing of *A. cerana*with an objective of to study the feasibility of rearing *A. cerana* in South Gujarat. Previous work on brood rearing activity of *A. cerana* was made by Sattigi and Lingappa (1994) at Dharwad, Rao *et al.*, (1996) at Balipal, Orissa, Ananda (2000), Das and Rahman (2000) at Assam and Mallikarjun (2000) at Bangalore.

MATERIAL AND METHODS

Three colonies of *A. cerana* of uniform strength reared in standard ISI- 8 type bee hives were selected for the study. The studies were made for a period of two years from March 2003 to February 2005. The data obtained were pooled and statistically analyzed considering one colony as a replication. During the first year no artificial feeding was provided to bee colonies to find out dearth period, if any. In second year, 50 per cent sugar feeding was given to all three colonies during June to mid August to overcome dearth period.

To study the seasonal variation, the whole year is divided into three seasons *i.e.* summer (March to June), monsoon (July to October) and winter (November to February). The colonies were examined regularly at fortnightly interval and observation on colony growth parameters like total brood area, which include area under egg, larvae and pupa of the worker bee, area under pollen store and honey stores were recorded utilizing standard technique suggested by Jeffree (1958) and Skowronck and Marcinkowski (1984). For the purpose, a wire grid was fabricated which consists of square in inches was utilized to measure area under respective colony growth parameters. The data on colony growth parameters were converted in to cm^2 by multiplying the number of square with 6.45. Both the sides of frames were measured. The observations on the number of frames covered with bees were also recorded during evening hours when all the bees returned to the hive.

RESULTS AND DISCUSSION

Brood rearing

The brood rearing activity of *A. cerana* was measured in area under brood (egg, grub and pupa). The analysis of the pooled data of two years, 2003-04 and 2004-05 on brood area presented in Table 1 revealed that the interaction effect of season, fortnight and the year was non-significant indicating consistent performance of different colonies over different season, fortnight and years. The mean area under total brood was higher in the second fortnight of January (1262.65 cm^2), which was statistically at par with the second fortnight of January (1221.80 cm^2). The minimum area under total brood was in the first fortnight of August (210.72 cm^2), which was at par with second fortnight of July (225.33 cm^2), second fortnight of August (233.82 cm^2), first fortnight of July (266.61 cm^2), first fortnight of September (293.48 cm^2) and second fortnight of June (302.40 cm^2). With regard to seasonal variation, the winter season proved its superiority by demonstrating significantly higher area under total brood (1082.06 cm^2) as compared to summer (496.41 cm^2) and monsoon (373.85 cm^2). Sattigi and Lingappa (1994) at Dharwad, Karnataka observed greater brood rearing during January – March and minimum in July.

Rao *et al.* (1996) noted lowest brood rearing in June to August, December – March were good for brood condition in colony and in April – May colony showed decreasing trend at Balipal, Orissa. Das and Rahman (2000) recorded minimum area under total brood during August at Assam. Ananda (2000) and Mallikarjun (2000) both at Bangalore observed higher brood rearing during January and minimum in July which support the present findings on brood rearing activity of *A. cerana* in south Gujarat.

Pollen store

The analysis of pooled data of two years on area under pollen store revealed that the pollen store was significantly higher during first fortnight of February (283.81cm^2) which was at par with second fortnight of January (270.35 cm^2), second fortnight of February (269.83 cm^2) and first fortnight of January (259.08 cm^2) (Table 2). The minimum area under pollen store was recorded in first fortnight of August (49.45 cm^2) which was comparable with second fortnight of August (56.45 cm^2), first fortnight of July (58.58 cm^2), second fortnight of July (58.63 cm^2), second fortnight of June (72.57 cm^2) and first fortnight of June (73.10 cm^2). Ramchandran and Mahadevan (1950) reported greater pollen store in February and reduced pollen store during rainy season at Coimbatore. Rahman and Rahman (1993) observed higher pollen area in February. Ananda (2000) and Mallikarjun (2000) observed higher pollen store in January and minimum during July at Bangalore, which supports the present findings.

Honey store

The perusal of analysis of pooled data on honey store of two years revealed the non significant interaction among season, fortnight and the year (Table 3). The second fortnight of February recorded significantly higher mean area under honey store of 979.72 cm^2 which was at par with first fortnight of February (962.66 cm^2). The second fortnight of July recorded significantly minimum honey store of 96.75 cm^2 which was at par with first fortnight of August (101.05 cm^2), first fortnight of July (108.04 cm^2), second fortnight of August (125.78 cm^2), first fortnight of June (135.45 cm^2) and second fortnight of June (138.68 cm^2). Similar results were reported by Ramchandran and Mahadevan (1950), who reported greater amount of honey store in February at Coimbatore. Reddy (1980) reported higher honey store in February at Bangalore. Ananda (2000) and Mallikarjun (2000) reported higher honey store during January and minimum during July, which is in close agreement with the present findings.

CONCLUSION

The overall, it can be evident that brood rearing activity of *A. cerana* continuously declined from March onwards, reached minimum in second fortnight of Augus then started increasing and reached to its peak during second fortnight of January.

REFERENCES

Ananda, M. R. (2000). Studies on morphometric characters and behavioural traits of Indian honeybee, *Apisceranaindica*Fabricius from different locations of Karnataka, M.Sc.(Agri.) Thesis (unpublished) submitted to University of Agricultural Sciences, Bangalore. Pp. 68.

Das, P.K. and Rahman, A. (2000). Brood rearing activity of *Apisceranaindica* F. in Assam. *Crop Res.*, **19**(3): 469-473.

Jeffree, E. P. (1958). A shaped wire grid for estimating quantities of

brood and pollens in combs. *Bee World*, **39**(5): 115-118.

Mallikarjun, S.J. (2000). Studies on seasonal fluctuations of *Apiscerana*Fabricius at UAS, G.K.V.K. Apiary, Bangalore. M.Sc. (Agri.) Thesis (unpublished) submitted to University of Agricultural Sciences, Bangalore. pp. 89.

Rahman, S. and Rahman, A. (1993). Comparative pollen gathering activity of *Apiscerana* F. and *Apismellifera* L. under Jorhat condition of Assam (India). *Indian Bee J.*,**55**: 42-46.

Ramchandran, S. and Mahadevan, V. (1950). Preliminary studies on brood rearing and hive population of *Apisindica* F. *Indian Bee J.*, **12**: 154-159.

Rao, G. M. (1997). Meet the beekeeper: HarshadbhaiKalidas Patel of Gandevi, Gujarat. *Indian Bee J*., **59**(3); 189-190.

Rao, G.M.; Majamdar, S.M.; Subha Rao, K and Dhas, J.R.K. (1996). Studies on management of *Apiscerana*Fabr. Colonies in the coastal area of Orissa, India. *Indian Bee J.*,**58**(3):117-121.

Sattigi, H.N. and Lingappa, S. (1994). Performances of Indian hive bee *Apiscerana* F. in Dharwad, Karnataka (India). *Karnataka J. Agric. Sci.*, **7**(3): 360-362.

Skowronck, W. and Marcinkowski, J. (1984). Suitability of different methods of brood area measurement for the development of honeybee colony. *Pszczel.Zesz.Nauk*,**28**: 5-14.

Table 1: Total brood area of *Apis cerana* F. in different fortnights and years.

Season	Month and Fortnight	Area Under Total Brood* cm^2		
		2003-04	**2004-05**	**Pooled**
Summer	March I	634.80	799.81	713.30
	March II	563.31	685.86	624.58
	April I	526.75	609.86	568.31
	April II	475.16	570.83	522.99
	May I	423.63	528.91	476.27
	May II	364.43	478.38	421.41
	June I	273.13	398.83	337.98
	June II	232.21	372.59	302.40
	Mean	**437.18**	**555.64**	**496.41**
Monsoon	July I	205.33	327.89	266.61
	July II	164.88	286.18	225.33
	August I	135.46	285.97	210.72
	August II	123.63	344.01	233.82
	September I	149.43	437.53	293.48
	September II	328.96	583.73	456.35
	October I	363.36	743.90	553.63
	October II	656.83	844.96	750.89
	Mean	**265.93**	**481.77**	**373.85**
Winter	November I	804.10	989.00	896.55
	November II	913.76	1115.86	1014.81
	December I	998.46	1166.38	1082.42
	December II	1035.24	1254.53	1144.88
	January I	1115.86	1327.74	1221.80
	January II	1169.61	1355.69	1262.65
	February I	965.36	1226.58	1095.97
	February II	834.20	1040.61	937.40
	Mean	**979.58**	**1184.55**	**1082.06**
SEm ± (Season)		24.76	13.58	26.68
SEm ± Season x Fortnight		70.04	38.41	38.39
SEm ± Year x Season x Fortnight		--	--	56.48
C.D. Season		70.54	38.69	162.37
C.D. Season x Fortnight		199.52	109.43	107.74
C.D @ 5% YSF		--	--	NS
C.V.%		21.63	8.98	15.03

- ***Mean of three colonies***

Table 2: The mean area under pollen store of *A. cerana* F. in different fortnights and years.

Season	Month and Fortnight	Area Under Honey Store* cm^2		
		2003-04	**2004-05**	**Pooled**
Summer	March I	180.60	223.60	202.10
	March II	175.23	214.41	194.82
	April I	153.73	180.72	167.22
	April II	120.36	154.80	137.58
	May I	102.13	138.77	120.45
	May II	102.12	127.92	115.02
	June I	58.05	88.15	73.10
	June II	56.98	88.15	72.57
	Mean	**118.65**	**152.07**	**135.36**
Monsoon	July I	45.15	72.02	58.58
	July II	40.94	76.33	58.63
	August I	25.80	73.10	49.45
	August II	30.10	82.80	56.45
	September I	47.30	111.80	79.55
	September II	106.36	137.60	121.98
	October I	88.15	165.39	126.77
	October II	139.75	199.95	169.85
	Mean	**65.44**	**114.87**	**90.16**
Winter	November I	166.63	225.75	196.19
	November II	194.58	240.80	217.69
	December I	219.30	252.63	235.97
	December II	253.70	258.00	255.85
	January I	260.15	258.00	259.08
	January II	268.72	271.98	270.35
	February I	274.13	293.48	283.81
	February II	264.46	275.20	269.83
	Mean	**237.71**	**259.48**	**248.59**
SEm ± (Season)		4.83	4.46	4.65
SEm ± Season x Fortnight		13.66	12.62	9.28
SEm ± Year x Season x Fortnight		--	--	13.16
C.D. Season		13.97	12.71	13.08
C.D. Season x Fortnight		38.94	35.96	26.06
C.D @ 5% YSF		--	--	NS
C.V.%		16.84	12.46	14.42

**** Mean of three colonies***

Table 3: The mean area under honey store of *A. cerana* F. in different fortnights and years.

Season	Month and Fortnight	Area Under Honey Store* cm^2		
		2003-04	**2004-05**	**Pooled**
Summer	March I	533.200	503.10	518.15
	March II	498.80	477.30	488.05
	April I	394.53	452.58	423.55
	April II	367.65	423.55	395.60
	May I	277.35	391.18	334.27
	May II	184.90	309.60	247.25
	June I	115.03	155.88	135.45
	June II	102.13	175.23	138.68
	Mean	**309.20**	**361.05**	**335.13**
Monsoon	July I	47.30	168.78	108.04
	July II	31.18	162.32	96.75
	August I	60.20	141.90	101.05
	August II	91.37	160.18	125.78
	September I	111.80	215.00	163.40
	September II	183.82	255.85	219.84
	October I	216.08	309.60	262.84
	October II	242.95	382.70	312.83
	Mean	**123.08**	**224.54**	**173.81**
Winter	November I	346.15	467.63	406.89
	November II	421.40	513.68	467.54
	December I	464.40	578.35	521.38
	December II	492.35	670.80	581.57
	January I	637.48	789.05	713.26
	January II	715.95	853.55	784.75
	February I	914.83	1010.50	962.66
	February II	891.03	1068.42	979.72
	Mean	**610.45**	**744.00**	**679.22**
SEm ± (Season)		9.93	7.29	20.58
SEm ± Season x Fortnight		28.10	20.61	17.81
SEm ± Year x Season x Fortnight		--	--	24.64
C.D. Season		28.31	20.76	125.24
C.D. Season x Fortnight		80.07	58.73	49.98
C.D @ 5% YSF		--	--	NS
C.V.%		14.10	8.06	10.80

**** Mean of three colonies***

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