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Screening of horsegram accessions towards Pulse beetle, *Callosobruchus chinensis* (Linnaeus.) under laboratory condition

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Abstract
Screening studies of horsegram accessions towards pulse beetle, *Callosobruchus chinensis* under laboratory conditions were carried out at Regional Research Station, Paiyur during the year 2016 for a period of nine months. The results showed that the maximum number of eggs were laid in only two accessions *viz*., Poonamalli 2 (70.0 No.s) and in Hosur 3 (65.5 No. of eggs). The minimum number of eggs was laid in only one accession in case of KPT 20 Kr (10 eggs) which contributed for bruchid resistance. The maximum number of accessions (385 Nos) fall under the category of 10-20 eggs laid followed by 274 accessions with laid eggs of 20-30 Nos and seventy nine accessions with egg laying capability of 30-40 Nos per accession. Out of 760 accessions, fifty per cent of accessions contributed for resistance, 36.05 per cent for moderate resistance and 21.0 per cent towards moderate susceptible to susceptible nature to *C. chinensis.* The per cent loss studies due to bruchids showed that the per cent loss ranged from 0.0-15.46 and the highest 15.46 was reported in 12 accessions tested. The highest number of eggs laid (35.0 Nos) and 4.5 seed damage was reported in PYR 2 variety. The lowest number of eggs was laid in Paiyur Acc 15 (15.5 Nos) with six per cent of affected seeds. The per cent affected seeds were found to be highest in Paiyur Acc 3 with 20 per cent damage.

Keywords: Screening, horsegram, *Callosobruchus chinensis*, laboratory studies

Introduction
Pulses are important source of protein and help to meet the nutritional needs of the people. Among the pulses, horse gram, *Macrotyloma uniflorum* Lam. is known as poorman's pulse crop in South India and grown in an area of 1.23 lakh hectare with an annual production of 0.53 lakh tonnes. It is being cultivated in an area of 82000 ha in Northwestern zone of Tamil Nadu. It is rich in protein source with medicinal values in curing Asthma, bronchitis, leucoderma and heart disease. Apart from this, raw grains of horse gram as antidiabetic and antioxidant properties. Pulse beetle also known as bruchids are known to cause considerable losses affecting the quantity and quality of seeds under storage conditions. Singh and Sharma (1982) [4] estimated 47.53 – 79.60 per cent loss of germination due to damaged grains. In India, 117 species belongs to 11 Genera have been recorded. Among them, *Callosobruchus maculatus* (F.), *C. chinensis* (L.) and *C. analis* (F) are the three important species reported in India. In North western zone of Tamil Nadu, *C. chinensis* is the most common species reported in horse gram. Being legume crop, horsegram also has a greater susceptibility to bruchid attack resulting in quantitative and qualitative losses. Hence, the preliminary studies on screening of various horsegram accessions to the infestation of bruchids under laboratory conditions was carried out to identify the susceptible/ resistance genotypes as a first line of defense in insect pest management

Materials and Methods
Screening of seven hundred and sixty horse gram accessions was carried out at Regional Research Station, Paiyur for a period of nine months (February 2016 – October 2016) under laboratory conditions. Out of seven hundred and sixty, fifty horsegram accessions were screened per month due to the huge sample size and for mass culturing of pulse beetle. The seeds of all the accessions were obtained from the field raised during rabi 2015, (i.e), from each accession, the pods were threshed and 100 g of seeds were taken per accession to conduct the laboratory experiments. After screening all the accessions, accessions collected from Dharmapuri and Krishnagiri districts (11 Nos) and ruling varieties of these regions (PYR 1&2) alone were screened as they were in the pipeline of development of new varieties with good qualities under crop improvement due to its suitability for adaptation in these districts so as to provide the details on the varietal resistance towards major storage insect pest.

Simultaneously, for continuous supply of pulse beetles for laboratory screening, the beetles were reared on fresh green gram seeds disinfested by keeping at -20 °C for 48 h in deep freezer in moisture proof container to kill all the existing insects. About 200 g green gram seeds were placed in 600ml plastic containers, into which approximately 50 pairs of freshly emerged adults were introduced. The containers were covered with muslin cloth and placed in dark to facilitate maximum oviposition, maintained at a room temperature of 30°C and 70% RH. After about 25 -30 days, the adults that emerged from the culture were utilized for the screening studies of various horse gram accessions. Sub-culturing of this beetle was done at weekly intervals for continuous supply of insects for conducting the experiments in a continuous manner.

For laboratory screening, five pairs of freshly emerged adults in 50 g of each horse gram accessions in two replications were taken in small petridishes and kept for a period of three days and the number of eggs laid per accession was observed on five days after release. Due to the huge sample size and to maintain uniformity among the accessions tested, the accessions tested were categorized in to two groups on the basis of number of eggs laid per accession and the per cent loss per accession caused due to *C. chinensis.* Based on the number of eggs laid, the horsegram accessions were grouped in to seven categories *viz*., 5-10, 10-20, 20-30, 30-40, 40-50, 50-60 and 60-70 Nos laid per accession. Afterwards, the petridishes were kept for a period of three months in insect cages and after the stipulated time period, one hundreds seeds were taken for sorting of healthy and damaged seeds and then the per cent loss was calculated using the following formula for four hundred germplasm accessions and categorization of different accessions was made with four rating scales (0-5, 5-10, 10-15 and 15-20%), as the accessions tested fall under the category of 1-20 per cent loss. The data, thus obtained for promising accessions were subjected to statistical analysis using AGRES package (Gomez and Gomez, 1984) [1].

$$\text{Mass loss (\%)} = \frac{(U.\,Nd) \quad - \quad (D.\,Nu)}{U\,(Nd + Nu)} \text{ X100}$$

where,
U = Mass of undamaged grains
Nu= Number of undamaged grains
D = Mass of damaged grains and
Nd= Number of damaged grains

Results and Discussion

The results on the study of screening of horse gram accessions (760 Nos) under laboratory condition were categorized and presented in Table 1. The results showed that the maximum number of eggs were laid in only two accessions *viz*., poonamalli 2 (70.0 No.s) and in Hosur 3 (65.5 No. of eggs). The minimum number of eggs was laid in only one accession in case of KPT 20 Kr (10 eggs) which contributed for bruchid resistance. The horsegram accessions which were categorized based on the number of eggs laid presented in Table 1 and per cent loss results obtained were presented in Table 2. The maximum number of accessions (385 Nos) fall under the category of 10-20 eggs laid followed by 274 accessions with laid eggs of 20-30 Nos and seventy nine accessions with egg laying capability of 30-40 Nos per accession. Out of 760 accessions, fifty per cent of accessions contribute for resistance and 36.05 per cent for moderate resistance and twenty one per cent under moderate susceptible to susceptible nature towards *C. chinensis.* With respect to category on per cent loss, it has been categorized in to four groups (0-5, 5-10, 10-15 & 15-20), out of which none of the accessions were grouped under third category of 10-15 per cent loss. Out of 400 horsegram accessions, 282 accessions caused the loss between 0-5 percent, 106 accessions between 5-10 per cent and 12 accessions under 15-20 per cent. The highest per cent loss of 15.46 was reported in 12 accessions tested. The lowest per cent loss of 0-5 per cent was reported in 282 accessions and accounted for 70.5 per cent contributed for low susceptibility and only 3.0 per cent being contributed for moderately susceptible nature towards the infestation of *C. chinensis* in controlled condition.

In order to assess the performance of the ruling varieties and promising accessions as per yield parameters (13 Nos) available at Regional Research Station, Paiyur alone were screened and presented in Table 3. Out of thirteen promising accessions tested, the number of eggs laid varied from 15.5 – 35.0 Nos per accession with the highest number of eggs laid in PYR 2 variety (35.0 Nos) with 4.5 per cent seed damage. The lowest number of eggs was laid in PYR Acc 15 (15.5 Nos) with six per cent of affected seeds. The per cent affected seeds were found to be highest in PYR Acc 3 with 20 per cent damage. The results showed that there occurred great difference in the susceptibility towards pulse beetle with the available horsegram accessions tested and contributes for resistance studies in future with supporting physical and biochemical factors of resistance studies. The studies on the screening of horsegram cultures against Pulse beetle are very meager. However, Shafique and Ahmad (2002) [3] and Khatak *et al*., 1987 [2] revealed that oviposition, adult progeny development and grain weight loss varied significantly among cultivars/ promising lines of pulses. Hence, in future while evaluating / introducing / development of new varieties, the resistant entries identified may act as a source of resistance and in-depth studies on other contributing factors of resistance should be taken in to account for the promising cultures/genotypes etc in breeding programmes.

Table 1: Screening of horse gram accessions against *C. chinensis* under laboratory condition

S. No	Acc. Name	Eggs laid (No.)	S.No	Acc. Name	Eggs laid (No.)	S. No	Acc. Name	Eggs laid (No.)	S.No	Acc. Name	Eggs laid (No.)
1.	KK 30 r	23.5	191.	HG 175	20.0	381.	KDM 13	15.5	571	Acc 571	40.0
2.	HA871-5-67-2	18.5	192.	Papparapatti	22.5	382.	G 175	20.0	572	Acc 572	25.0
3.	Bangalore 208	17.0	193.	HG 52	18.0	383.	HPK 1	19.0	573	Acc 573	23.5
4.	12 EB	21.5	194.	Paiyur Acc 5	16.0	384.	Polur 348	18.5	574	Acc 574	25.0
5.	HYD 90-20 kr	18.5	195.	DPI 1335	20.5	385.	Nagpur	17.5	575	Acc 575	21.0
6.	KK 20 r	10.5	196.	KPM 10	25.0	386.	Paiyur 13	14.5	576	Acc 576	17.5
7.	KPT 20 Kr	10.0	197.	Srivaikundam	30.0	387.	DPI 1238	19.0	577	Acc 577	18.5
8.	Bangalore 302	17.0	198.	Kpatti	33.5	388.	IC 9626	20.0	578	Acc 578	15.0
9.	Bangalore 96	13.5	199.	DPI 1235	33.0	389.	Poonampalli 2	70.0	579	Acc 579	20.5

10.	10 EB	13.0	200.	Paiyur Acc 6	29.0	390.	Chinathadagam2	19.5	580	Acc 580	23.0
11.	14 EC	36.0	201.	Pollachi	34.5	391.	KDM 11	18.5	581	Acc 581	23.0
12.	13 EB	31.5	202.	Kothapatti	39.5	392.	JKT 2	21.5	582	Acc 582	24.0
13.	VLM-1	17.0	203.	Agaram 1	17.5	393.	CO DB 5	18.0	583	Acc 583	22.0
14.	Tenkasi-buff	16.5	204.	Anthiyur	16.5	394.	Dharmapuri2	18.5	584	Acc 584	24.5
15.	HPK-4	16.5	205.	V20 Block	26.5	395.	IC 9623	15.5	585	Acc 585	25.5
16.	HPK-2	14.0	206.	N.G. palayam	28.0	396.	Morappur red	20.0	586	Acc 586	25.5
17.	Srivaikundan	12.5	207.	PLS 22 buff	30.0	397.	IC 8606	24.5	587	Acc 587	16.5
18.	HG 6K-20	12.5	208.	HPM 3	17.5	398.	T45	17.5	588	Acc 588	29.0
19.	HG 102	14.5	209.	Katheria 16	17.0	399.	Avaipalayam	25.5	589	Acc 589	39.5
20.	HG 20	14.5	210.	Paiyur Acc 8	20.0	400.	KDM 9	32.0	590	Acc 590	31.5
21.	VZM-1	16.0	211.	Tekkalur – 1	21.5	401	Acc 401	24.5	591	Acc 591	26.0
22.	HG 92-5-67/26	22.0	212.	KPM 7	25.0	402	Acc 402	20.5	592	Acc 592	28.5
23.	JND-1	14.5	213.	IC 10938	21.0	403	Acc 403	22.5	593	Acc 593	21.0
24.	Pattambi	13.5	214.	KPM 8	25.0	404	Acc 404	25.5	594	Acc 594	19.5
25.	Kambainallur	17.0	215.	DPI 1286	29.0	405	Acc 405	19.0	595	Acc 595	23.0
26.	Marugapuri	16.0	216.	Paiyur 6	13.0	406	Acc 406	11.0	596	Acc 596	27.5
27.	IC9628	16.5	217.	HPk -7	16.0	407	Acc 407	10.5	597	Acc 597	28.5
28.	Cholachi	16.0	218.	Bellary buff- 1668	21.5	408	Acc 408	15.0	598	Acc 598	34.0
29.	Mathipalli	17.0	219.	Pennagram	17.0	409	Acc 409	15.0	599	Acc 599	33.0
30.	T45	16.5	220.	DPI 1240	24.0	410	Acc 410	16.0	600	Acc 600	32.0
31.	Morappur-1	17.0	221.	DPI 1241	12.0	411	Acc 411	36.5	601	Acc 601	33.0
32.	Vitalur	13.0	222.	Paiyur 4	16.5	412	Acc 412	31.0	602	Acc 602	35.5
33.	KPM 6	17.0	223.	Paiyur 1	21.5	413	Acc 413	16.5	603	Acc 603	21.5
34.	Paichal	20.0	224.	IC 8595	15.5	414	Acc 414	16.5	604	Acc 604	19.5
35.	Trichy Buff	17.0	225.	Nagandapalli-2	19.0	415	Acc 415	16.0	605	Acc 605	27.0
36.	APLS 888	19.5	226.	Paiyur 5	17.0	416	Acc 416	15.0	606	Acc 606	30.0
37.	Karungallur	13.5	227.	IIEJ	14.5	417	Acc 417	15.0	607	Acc 607	31.5
38.	Hebbal-1	12.5	228.	Srivaikundam	14.0	418	Acc 418	16.0	608	Acc 608	18.5
39.	Poonmalli-3	14.5	229.	HG 23	13.0	419	Acc 419	18.0	609	Acc 609	18.0
40.	Tenkasi	20.0	230.	HYD 96	20.5	420	Acc 420	16.5	610	Acc 610	21.5
41.	Ambasamudram	15.5	231.	HYD	16.5	421	Acc 421	17.0	611	Acc 611	24.5
42.	Ponmalli-4	14.5	232.	HYD 30 Kr	15.0	422	Acc 422	23.0	612	Acc 612	29.0
43.	Dpi 1332	16.5	233.	PM 16	17.0	423	Acc 423	15.0	613	Acc 613	22.0
44.	Mecheri	13.5	234.	DPI 1335	20.0	424	Acc 424	19.0	614	Acc 614	28.0
45.	Chinnathadagam	13.5	235.	Bellary long	21.5	425	Acc 425	18.0	615	Acc 615	31.5
46.	Paiyur1	15.5	236.	IC 869	27.0	426	Acc 426	18.5	616	Acc 616	17.5
47.	Cuddalore	14.0	237.	Kothapatti	18.0	427	Acc 427	19.0	617	Acc 617	23.0
48.	DPI 1240	22.0	238.	DPI 58	15.5	428	Acc 428	19.0	618	Acc 618	24.5
49.	DPI 1241	23.0	239.	IC 8595	14.0	429	Acc 429	20.0	619	Acc 619	20.0
50.	IC 9606	17.5	240.	HYD local	17.5	430	Acc 430	18.5	620	Acc 620	25.0
51.	VLM Buff	19.5	241.	Pero	14.5	431	Acc 431	17.5	621	Acc 621	13.0
52.	PLS-9	17.5	242.	G 175	25.0	432	Acc 432	18.0	622	Acc 622	17.5
53.	KPT 20 Kr	14.5	243.	PDP 1	12.5	433	Acc 433	18.0	623	Acc 623	24.5
54.	IC 9626	18.5	244.	Nagandapalli	17.5	434	Acc 434	21.5	624	Acc 624	25.5
55.	Chettipalayam	13.0	245.	DPI 1286	17.5	435	Acc 435	19.5	625	Acc 625	21.0
56.	VLM-9	15.5	246.	PLS 229	17.0	436	Acc 436	22.0	626	Acc 626	32.0
57.	Madamblock	15.0	247.	Karunga local	19.0	437	Acc 437	20.0	627	Acc 627	23.5
58.	Kollapatti	36.0	248.	KL1	15.5	438	Acc 438	17.5	628	Acc 628	15.5
59.	Paiyur2	40.0	249.	KL2	17.5	439	Acc 439	18.5	629	Acc 629	14.5
60.	NA2	39.0	250.	KL 3	12.5	440	Acc 440	23.0	630	Acc 630	23.5
61.	KPM 2	20.0	251.	KL 4	28.0	441	Acc 441	16.5	631	Acc 631	20.5
62.	Podurode	24.0	252.	KL 5	26.0	442	Acc 442	19.5	632	Acc 632	17.0
63.	DPI 1230	28.0	253.	KL 6	21.5	443	Acc 443	22.0	633	Acc 633	21.0
64.	DPI 1233	39.5	254.	KL 7	25.5	444	Acc 444	22.0	634	Acc 634	24.0
65.	KPM 9	30.5	255.	KL 8	16.5	445	Acc 445	18.5	635	Acc 635	28.0
66.	Rasipuram 3	18.5	256.	KL 9	24.5	446	Acc 446	14.5	636	Acc 636	34.0
67.	Sankarankovil	21.5	257.	KL 11	14.0	447	Acc 447	13.5	637	Acc 637	23.0
68.	Sankarankovil	30.5	258.	KL 12	13.0	448	Acc 448	18.0	638	Acc 638	16.5
69.	Poonamalli -1	21.5	259.	KL 13	14.0	449	Acc 449	19.0	639	Acc 639	17.5
70.	Gopichettiplayam	16.0	260.	KL 14	23.5	450	Acc 450	19.0	640	Acc 640	21.0
71.	DPI 1229	14.0	261.	KL 15	19.0	451	Acc 451	20.0	641	Acc 641	24.0
72.	DPI 1238	19.0	262.	KL 16	16.5	452	Acc 452	18.5	642	Acc 642	30.0
73.	Yadagiri	26.0	263.	KL 17	14.5	453	Acc 453	15.5	643	Acc 643	14.5
74.	Avanasi	30.5	264.	KL 18	16.0	454	Acc 454	19.0	644	Acc 644	19.5
75.	Madamblock	34.5	265.	KL 19	20.0	455	Acc 455	13.0	645	Acc 645	23.0
76.	Bellary buff	31.5	266.	KL 20	20.0	456	Acc 456	16.5	646	Acc 646	21.5
77.	KPM-8	23.5	267.	KL 21	14.5	457	Acc 457	16.0	647	Acc 647	21.0
78.	PYR-7	20.0	268.	KL 22	16.0	458	Acc 458	25.5	648	Acc 648	20.5

79.	Omalur	20.0	269.	KL 24	22.0	459	Acc 459	36.0	649	Acc 649	25.0
80.	IC 869	17.5	270.	KL 25	16.0	460	Acc 460	40.0	650	Acc 650	23.0
81.	Paiyur Acc 7	15.5	271.	KL 26	27.0	461	Acc 461	21.0	651	Acc 651	30.0
82.	DPI 1233	39.0	272.	KL 27	17.0	462	Acc 462	24.5	652	Acc 652	29.5
83.	Theni	39.0	273.	KL 28	17.0	463	Acc 463	29.5	653	Acc 653	27.5
84.	DPI 1239	30.0	274.	KL 29	20.0	464	Acc 464	38.0	654	Acc 654	29.0
85.	Tindivanam	21.5	275.	KL 31	27.5	465	Acc 465	29.0	655	Acc 655	23.5
86.	Nagandapalli	17.0	276.	KL 32	25.0	466	Acc 466	20.5	656	Acc 656	16.5
87.	IC 9628	30.0	277.	KL 33	26.5	467	Acc 467	22.5	657	Acc 657	19.0
88.	Srivaikundam -2	16.0	278.	KL 36	15.5	468	Acc 468	28.5	658	Acc 658	18.5
89.	R.S	29.0	279.	KL 37	18.0	469	Acc 469	28.0	659	Acc 659	15.0
90.	Kambainallur – 2	24.5	280.	KL 38	25.0	470	Acc 470	17.5	660	Acc 660	19.5
91.	Pattambi	22.0	281.	KL 39	15.5	471	Acc 471	20.0	661	Acc 661	18.5
92.	Rajendranagar	19.0	282.	KL 41	38.0	472	Acc 472	20.5	662	Acc 662	15.5
93.	Madam 1	20.5	283.	KL 42	31.5	473	Acc 473	26.5	663	Acc 663	12.0
94.	PLK V5	20.0	284.	KL 43	27.5	474	Acc 474	31.5	664	Acc 664	12.0
95.	Periyakulam	39.5	285.	KL 51	21.5	475	Acc 475	36.0	665	Acc 665	15.5
96.	IC 8619	36.5	286.	KL 52	16.5	476	Acc 476	33.5	666	Acc 666	20.5
97.	RPM 5	36.5	287.	KL 53	20.0	477	Acc 477	22.5	667	Acc 667	17.5
98.	Tekkalur – 1	29.5	288.	KL 58	17.5	478	Acc 478	24.5	668	Acc 668	17.0
99.	T42	26.5	289.	KL 65	20.0	479	Acc 479	23.5	669	Acc 669	22.5
100.	Kallar	30.5	290.	KL 66	32.5	480	Acc 480	23.0	670	Acc 670	17.0
101.	IC 9623	23.0	291.	KL 67	30.0	481	Acc 481	15.0	671	Acc 671	22.5
102.	Srivaikundam-4	14.5	292.	KL 69	20.0	482	Acc 482	29.5	672	Acc 672	22.5
103.	Poonmalai 2	34.0	293.	KL 70	17.5	483	Acc 483	25.5	673	Acc 673	19.0
104.	Puduchatram	34.5	294.	KL 81	19.5	484	Acc 484	27.5	674	Acc 674	22.0
105.	Pyr Acc10	24.5	295.	KL 82	24.0	485	Acc 485	24.5	675	Acc 675	26.5
106.	Chetty	30.0	296.	KL 83	35.5	486	Acc 486	19.0	676	Acc 676	29.5
107.	Kuruvai	27.0	297.	KL 84	20.0	487	Acc 487	23.5	677	Acc 677	27.0
108.	APLS 886	31.0	298.	KL 85	16.0	488	Acc 488	18.5	678	Acc 678	23.5
109.	Ramagoundampatti	32.0	299.	KL 86	15.5	489	Acc 489	32.5	679	Acc 679	19.5
110.	HYD	33.0	300.	KL 87	13.5	490	Acc 490	27.0	680	Acc 680	21.0
111.	Baliahangal	47.5	301.	KL 89	21.5	491	Acc 491	24.0	681	Acc 681	20.5
112.	PLS 22 Buff	49.5	302.	KL 90	23.0	492	Acc 492	21.0	682	Acc 682	24.0
113.	PLS 3	51.0	303.	KL 91	14.5	493	Acc 493	22.5	683	Acc 683	32.5
114.	DPI 1334	54.0	304.	KL 92	18.5	494	Acc 494	23.0	684	Acc 684	30.5
115.	Morappur 2	57.0	305.	KL 93	23.5	495	Acc 495	40.5	685	Acc 685	30.0
116.	Hosur 3	65.5	306.	KL 94	16.5	496	Acc 496	26.5	686	Acc 686	25.0
117.	PyrAcc 3	26.0	307.	KL 95	15.5	497	Acc 497	35.0	687	Acc 687	23.0
118.	Hosur 1	26.5	308.	KL 96	14.5	498	Acc 498	25.0	688	Acc 688	18.5
119.	K.K	17.5	309.	KL 97	15.5	499	Acc 499	21.0	689	Acc 689	21.0
120.	AKT 1	17.0	310.	KL 98	19.0	500	Acc 500	30.0	690	Acc 690	31.5
121.	HPk 6	13.0	311.	KL 99	17.0	501	Acc 501	25.0	691	Acc 691	31.5
122.	HG 6 K-20	17.5	312.	KL 100	13.0	502	Acc 502	16.5	692	Acc 692	25.0
123.	NZM 93	33.5	313.	KL 101	20.0	503	Acc 503	28.5	693	Acc 693	23.0
124.	DB7	40.0	314.	KL 102	13.0	504	Acc 504	30.0	694	Acc 694	29.0
125.	HG 23	39.0	315.	KL 103	35.0	505	Acc 505	27.5	695	Acc 695	22.5
126.	HG 102	25.0	316.	KL 104	27.0	506	Acc 506	29.0	696	Acc 696	29.5
127.	HG 5-35	18.0	317.	KL 105	16.5	507	Acc 507	25.0	697	Acc 697	21.0
128.	Kollankadu	16.5	318.	KL 44	18.0	508	Acc 508	32.5	698	Acc 698	19.5
129.	HG 73-57-4	23.0	319.	KL 45	18.5	509	Acc 509	33.5	699	Acc 699	19.5
130.	HG 110	18.5	320.	KL 46	13.0	510	Acc 510	35.0	700	Acc 700	18.0
131.	IC 9626	16.0	321.	KL 47	20.0	511	Acc 511	45.0	701	Acc 701	23.0
132.	HG 96	14.5	322.	KL 48	34.0	512	Acc 512	50.5	702	Acc 702	22.0
133.	KPT	28.0	323.	KL 49	16.5	513	Acc 513	47.5	703	Acc 703	18.5
134.	HYD local	22.0	324.	KL 50	20.5	514	Acc 514	48.0	704	Acc 704	17.0
135.	PLS 9	21.5	325.	KL 79	13.5	515	Acc 515	53.0	705	Acc 705	22.0
136.	KK30Kr	13.0	326.	KL 71	21.0	516	Acc 516	59.5	706	Acc 706	17.5
137.	14 EC	20.5	327.	KL 14	20.5	517	Acc 517	24.5	707	Acc 707	16.5
138.	KPT 20 Kr	16.5	328.	KL 45	19.5	518	Acc 518	24.0	708	Acc 708	19.5
139.	APLS 885	13.0	329.	KL 76	15.5	519	Acc 519	22.0	709	Acc 709	21.5
140.	H3	20.0	330.	KL 78	13.0	520	Acc 520	20.0	710	Acc 710	20.0
141.	APLS 887	19.5	331.	KL 79	15.5	521	Acc 521	18.5	711	Acc 711	17.5
142.	Periyakulam	13.0	332.	KL 77	18.0	522	Acc 522	25.0	712	Acc 712	14.5
143.	Hebbal 1	36.0	333.	KL 75	16.5	523	Acc 523	31.0	713	Acc 713	20.5
144.	IC 9606	20.0	334.	KL 73	16.5	524	Acc 524	33.0	714	Acc 714	13.5
145.	VLM buff	18.0	335.	KL 74	18.0	525	Acc 525	36.0	715	Acc 715	23.0
146.	KPM 11	17.5	336.	VLM Buff	14.5	526	Acc 526	25.0	716	Acc 716	27.5
147.	Hosur 11	22.0	337.	Kambainallur	16.0	527	Acc 527	25.0	717	Acc 717	24.5

				brown							
148.	IC 9620	31.0	338.	IC 8599	18.5	528	Acc 528	21.5	718	Acc 718	19.0
149.	Dharmapuri	19.0	339.	KDM 13	18.5	529	Acc 529	20.0	719	Acc 719	15.0
150.	Madam brown	23.0	340.	DGM	19.0	530	Acc 530	20.5	720	Acc 720	13.5
151.	DPI 1333	28.0	341.	Paiyur -9	18.5	531	Acc 531	22.5	721	Acc 721	18.5
152.	DPI 1230	20.0	342.	Madam -2	20.5	532	Acc 532	22.0	722	Acc 722	26.5
153.	H21	46.0	343.	Hosur 6	17.5	533	Acc 533	31.0	723	Acc 723	20.0
154.	DPI 1236	53.5	344.	Kambainallur red	13.5	534	Acc 534	24.0	724	Acc 724	14.0
155.	Mathipalli	20.0	345.	KDM 3	14.5	535	Acc 535	23.0	725	Acc 725	13.5
156.	APLS 888	26.5	346.	Pollachi –N	18.0	536	Acc 536	23.0	726	Acc 726	22.0
157.	PM 1	22.0	347.	Paiyur Acc14	24.5	537	Acc 537	21.0	727	Acc 727	16.0
158.	JKT 2	15.5	348.	KDM 4	17.5	538	Acc 538	21.5	728	Acc 728	15.0
159.	Rajendranagar	15.0	349.	VLM 1	22.5	539	Acc 539	20.0	729	Acc 729	17.5
160.	PLK V5	16.5	350.	V.N.palayam	29.5	540	Acc 540	26.0	730	Acc 730	19.0
161.	Kiliyur	18.0	351.	IC 8595	21.5	541	Acc 541	29.0	731	Acc 731	22.0
162.	DPI 1330	18.5	352.	PLKU 15	22.0	542	Acc 542	20.5	732	Acc 732	21.5
163.	Poonamalli 4	17.5	353.	Paiyur 15	14.5	543	Acc 543	31.5	733	Acc 733	20.0
164.	DPI 1332	19.0	354.	KDM 2	18.5	544	Acc 544	24.0	734	Acc 734	15.0
165.	DPI 76	16.0	355.	Kallavi	24.0	545	Acc 545	21.0	735	Acc 735	18.5
166.	DPI 46	19.5	356.	HPK 7	17.5	546	Acc 546	20.0	736	Acc 736	16.5
167.	DPI 45	13.0	357.	Bellary 1674	16.0	547	Acc 547	27.0	737	Acc 737	20.0
168.	DPI 37	48.0	358.	HPK 2	14.5	548	Acc 548	29.0	738	Acc 738	17.5
169.	DPI 21	42.0	359.	IC 9625	15.5	549	Acc 549	21.0	739	Acc 739	19.0
170.	DPI 14	38.0	360.	PLK U2	19.0	550	Acc 550	28.0	740	Acc 740	14.0
171.	HPK 2	37.0	361.	EC 28311	17.0	551	Acc 551	31.0	741	Acc 741	15.0
172.	HPK 4	28.5	362.	CODB6	12.0	552	Acc 552	21.5	742	Acc 742	18.5
173.	Kadava local	21.5	363.	DPI1232	19.0	553	Acc 553	29.0	743	Acc 743	18.0
174.	HG 20 (IC 861)	23.5	364.	DPI 1240	14.0	554	Acc 554	48.0	744	Acc 744	19.0
175.	HG 92	20.0	365.	VZM 93	26.5	555	Acc 555	23.5	745	Acc 745	20.0
176.	Mecheri	16.5	366.	Killiyur	24.5	556	Acc 556	29.0	746	Acc 746	19.5
177.	N.Puram	17.0	367.	Mecheri 1	17.5	557	Acc 557	17.0	747	Acc 747	21.0
178.	Cuddalore	14.0	368.	Mangalore 2	18.0	558	Acc 558	16.0	748	Acc 748	19.5
179.	Paiyur Acc 9	17.5	369.	TND 1	20.5	559	Acc 559	15.5	749	Acc 749	16.5
180.	Avinasi	21.5	370.	HPK 5	14.0	560	Acc 560	18.0	750	Acc 750	16.5
181.	DPI 1238	16.5	371.	PLK u32	20.5	561	Acc 561	21.0	751	Acc 751	17.0
182.	Pennagaram 2	22.0	372.	Trichy local	29.5	562	Acc 562	17.5	752	Acc 752	19.5
183.	PB 7	15.5	373.	Gobichettipalyam	20.5	563	Acc 563	19.5	753	Acc 753	18.0
184.	PM 1	20.5	374.	Bellary 1668	22.5	564	Acc 564	21.0	754	Acc 754	21.0
185.	TDP 1	23.0	375.	Pachal	13.0	565	Acc 565	17.0	755	Acc 755	27.0
186.	HG 49	19.5	376.	IC 9622	23.5	566	Acc 566	21.0	756	Acc 756	18.5
187.	PLS 229	17.0	377.	Bellary long	23.0	567	Acc 567	19.5	757	Acc 757	16.5
188.	Perur	34.0	378.	Rasipuram	21.5	568	Acc 568	43.5	758	Acc 758	13.0
189.	Alagapuri	48.0	379.	KDM 8	19.0	569	Acc 569	37.0	759	Acc 759	16.0
190.	HG 15	31.0	380.	Nagandapalli3	18.0	570	Acc 570	35.0	760	Acc 760	20.0

Table 2: Categorization of horse gram accessions against *C. chinensis* under laboratory condition

S. No	Eggs laid	No. of accessions	Category based on eggs laid	Per cent loss	No. of accessions	Category on per cent loss
1.	5-10	1	0.13	0-5	282	70.5
2.	10-20	385	50.65	5-10	106	26.5
3.	20-30	274	36.05	10-15	0	0
4.	30-40	79	10.39	15-20	12	3.0
5.	40-50	12	1.57	-	-	-
6.	50-60	7	0.92			
7.	60-70	2	0.26			
Total		760	-		400	

Table 3: Screening of promising varieties and accessions against *C. Chinensis*

S. No	Acc No.	Paiyur	Eggs laid (No.)	Damaged / 50 seeds	Affected seeds (%)
1.	46.	PYR1 (Variety)	27.0 ^{j}	5.5 ^{h}	11.0 ^{h}
2.	59.	PYR 2 (Variety)	35.0 ^{m}	4.5 ^{e}	9.0 ^{e}
3.	117.	PYR Acc 3	30.0 ^{k}	10.0 ^{l}	20.0 ^{m}
4.	222.	PYR Acc 4	21.0 ^{f}	8.5 ^{k}	17.0 ^{k}
5.	194.	PYR Acc 5	16.0 ^{b}	7.0 ^{j}	14.0 ^{j}
6.	200.	PYR Acc 6	31.0 ^{l}	1.5 ^{a}	3.0 ^{a}
7.	81.	PYR Acc 7	20.0 ^{e}	2.0 ^{b}	4.0 ^{b}
8.	210.	PYR Acc 8	24.5 ^{g}	5.0 ^{g}	10.0 ^{g}
9.	179.	PYR Acc 9	19.5 ^{d}	8.5 ^{k}	17.0 ^{l}
10.	105.	PYR Acc10	25.5 ^{h}	6.0 ^{i}	12.0 ^{i}

11.	386.	PYR Acc 13	17.0 [c]	4.5 [f]	9.0 [f]
12.	347.	PYR Acc14	26.5 [i]	2.0 [c]	4.0 [e]
13.	353.	PYR Acc15	15.5 [a]	3.0 [d]	6.0 [d]
SEd			4.30	0.62	1.24
CD<0.05			9.29	1.33	2.67

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