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Bioefficacy of Various Insecticides Against *Coccidohystrix insolita* (Green) on Pigeonpea*

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ABSTRACT

Laboratory (1990-91) and field (1991-92 & 1992-93) investigation was carried out to see the bioefficacy and economics of various insecticides against *Coccidohystrix insolita* (Green) on pigeonpea at Junagadh. Out of 18 insecticides, quinalphos and methyl parathion 0.05 per cent; dichlorvos, triazophos and monocrotophos 0.04 per cent and neemark 0.6 per cent were found highly effective against third nymphal instars of *C. insolita* under laboratory condition, whereas quinalphos, triazophos and monocrotophos were found most effective and gave above 98 per cent mortality of this pest within 10 days of application under field condition. The results also indicated that the lowest percentage of loss in grain yield and highest net profit per hectare were recorded from these treatments.

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INTRODUCTION

Recently, the mealybug, *Coccidohystrix insolita* (Green) has been found seriously infesting pigeonpea crop in isolated patches in the Gujarat State. It is commonly known as brinjal mealybug, has been reported by Chaudhary (1976) and Nair and Nair (1976) attacking brinjal. It has been also reported to feed on pigeonpea in Gujarat (Patel *et al.*, 1985b and Bhalani, 1990). Considering the economic importance of the pest, attempts were made to find out the effective and profitable insecticides against mealybug on pigeonpea.

MATERIALS AND METHODS

Laboratory study

Trial was conducted at Department of Entomology, Junagadh during 1990-91, in a completely randomized design with 3 replications and 18 different insecticides including botanical materials (Table 1) and water treated control. A laboratory reared third nymphal instar of *C. insolita* were used as test insects. Leaves of pigeonpea were placed in Patri dishes (9.0 cm x 9.0 cm) having moist blotting paper. Each insecticidal suspension was applied @ 2 ml per Petri dish with the help of atomizer and was dried under room

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TABLE 1

Per cent mortality of nymphs of *C. insolita* by insecticides at different hours on pigeonpea in laboratory.

Treatment	Concentration (%)	Per cent mortality of C. insolota hours after application					
		3	6	12	24	48	72
Acephate	0.04	17.70 (9.24)	20.26 (11.99)	26.88 (20.44)	28.92 (23.39)	33.47 (30.42)	33.97 (31.22)
Dichlorvos	0.04	25.56 (18.62)	38.67 (39.04)	54.25 (65.87)	84.23 (98.99)	84.23 (98.99)	84.23 (98.99)
Dimethoate	0.03	17.70 (9.24)	21.63 (13.59)	34.06 (31.37)	39.36 (35.20)	45.78 (51.36)	53.31 (64.30)
Endosulfan	0.07	20.08 (11.79)	28.60 (22.91)	35.81 (34.23)	36.06 (34.65)	39.36 (35.20)	41.68 (44.22)
Malathion	0.05	30.98 (26.50)	41.03 (43.09)	51.75 (61.67)	68.43 (86.48)	84.23 (98.99)	84.23 (98.99)
Methyl parathion	0.05	36.79 (35.87)	46.58 (56.23)	63.02 (79.42)	84.23 (98.99)	84.23 (98.99)	84.23 (98.99)
Monocrotophos	0.04	11.23 (3.79)	38.67 (39.04)	51.93 (61.98)	72.10 (90.55)	80.42 (97.23)	80.55 (97.30)
Phosphamidon	0.03	16.07 (7.66)	32.82 (29.38)	38.04 (37.97)	49.78 (58.30)	60.12 75.18)	64.60 (81.60)
Triazophos	0.04	5.74 (1.00)	40.34 (41.90)	60.39 (75.59)	84.23 (98.99)	84.23 (98.99)	84.23 (98.99)
Ghinalphos	0.05	39.16 (39.88)	54.50 (66.28)	73.41 (91.85)	84.23 (98.99)	84.23 (98.99)	84.23 (98.99)
Cartap	0.05	14.14 (5.97)	22.36 (14.47)	28.84 (23.27)	33.47 (30.42)	41.72 (44.29)	41.77 (44.37)

1.	2.	3.	4.	5.	6.	7.	8.
Indiara	0.50	5.74 (1.00)	17.26 (8.80)	26.88 (20.44)	30.88 (26.34)	33.53 (30.51)	34.09 (31.42)
Mint oil	0.50	11.23 (3.79)	19.92 11.61)	38.26 (39.34)	52.53 (62.99)	68.43 (86.48)	69.17 (87.36)
Neemark	0.50	14.79 (6.52)	27.70 (21.61)	46.16 (52.02)	48.18 (55.54)	73.55 (91.98)	80.42 (97.23)
Neemgaurd	0.50	16.42 (7.99)	19.53 (11.18)	29.50 (24.25)	45.78 (51.36)	54.74 (66.67)	63.41 (79.97)
Neem seed kernel suspension	3.00	11.23 (3.79)	16.62 (8.18)	22.81 (15.03)	28.92 (23.39)	36.06 (34.65)	40.66 (42.45)
Nicotine sulphate	0.05	11.23 (3.79)	22.55 (14.71)	47.80 (54.88)	53.93 (65.33)	64.97 (82.10)	68.09 (86.08)
Repelin	0.50	17.70 (9.24)	25.73 (18.85)	31.47 (27.25)	33.47 (30.42)	39.36 (40.22)	40.04 (41.39)
S. Em. ±		2.44	3.20	2.82	2.57	1.92	1.98
C. D. at 5%		6.98	9.14	8.06	7.35	5.49	5.66
C. V. %		22.66	18.64	11.54	8.37	5.48	5.45

Figures in parentheses are retransformed values.

TABLE 2

Pooled mean per cent reduction of *C. insolita* at different intervals after first and second sprays on pigeonpea in field (1991-92 and 1992-93).

Treatment	Concentration (%)	Mean per cent reduction of C. insolita days after spray									
		First spray					Second spray				
		1	2	3	7	10	1	2	3	7	10
Dichlorvos	0.04	44.72 (49.51)	50.85 (60.14)	54.31 (65.96)	57.42 (71.00)	58.17 (72.18)	45.99 (51.73)	53.38 (64.42)	59.44 (74.15)	65.04 (82.19)	67.74 (85.65)
Malathion	0.05	61.58 (77.35)	68.18 (86.18)	72.56 (91.02)	75.41 (93.65)	75.96 (94.11)	55.68 (68.21)	64.86 (81.95)	70.16 (88.48)	72.56 (91.02)	74.38 (92.75)
Methyl parathion	0.05	63.27 (79.77)	70.56 (88.92)	73.70 (92.12)	76.70 (94.71)	78.01 (95.68)	56.28 (69.18)	63.20 (79.67)	69.93 (88.22)	71.32 (89.74)	74.42 (92.79)
Monocrotophos	0.04	62.67 (78.92)	72.02 (90.47)	78.24 (95.85)	81.80 (97.97)	82.24 (98.18)	57.75 (71.53)	71.73 (90.17)	77.60 (95.39)	82.17 (98.14)	83.30 (98.64)
Phosphamidon	0.03	64.25 (81.13)	68.00 (85.97)	69.74 (88.01)	74.30 (92.68)	75.48 (93.71)	56.31 (69.23)	61.83 (77.71)	66.98 (84.71)	69.09 (87.26)	71.35 (89.77)
Triazophos	0.04	66.55 (84.16)	76.84 (94.82)	78.22 (95.83)	83.59 (98.75)	84.16 (98.96)	60.51 (75.77)	73.05 (91.50)	77.56 (95.36)	81.99 (98.06)	83.30 (98.64)
Quinalphos	0.05	70.99 (89.39)	80.94 (97.52)	82.45 (98.27)	83.50 (98.72)	84.66 (99.13)	70.60 (88.97)	75.83 (94.01)	78.05 (95.71)	80.90 (97.50)	82.50 (98.30)
Endosulfan	0.07	31.83 (27.82)	36.84 (35.95)	40.55 (42.26)	42.01 (44.79)	42.27 (45.24)	31.08 (26.65)	38.76 (39.20)	40.07 (41.44)	41.56 (44.01)	42.42 (45.50)
Mint oil	0.50	37.38 (36.86)	48.11 (55.42)	50.56 (59.64)	51.13 (60.62)	56.95 (70.26)	35.16 (33.16)	42.16 (45.05)	48.15 (55.49)	49.71 (58.18)	50.08 (58.82)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Neemark	0.50	52.51 (62.96)	63.02 (79.42)	65.94 (83.38)	70.34 (88.68)	72.32 (90.78)	44.63 (49.35)	52.83 (63.50)	58.15 (72.15)	62.11 (78.12)	64.43 (81.37)
Neemgaurd	0.50	29.44 (24.16)	45.45 (50.79)	49.02 (56.99)	55.14 (67.33)	55.98 (68.70)	29.05 (23.58)	39.14 (39.84)	47.00 (53.49)	53.52 (64.65)	55.29 (67.58)
Nicotine sulphate	0.05	36.67 (35.67)	47.04 (53.56)	48.56 (56.20)	51.15 (60.65)	51.48 (61.21)	35.84 (34.28)	45.57 (50.99)	50.54 (59.61)	53.73 (65.00)	54.22 (65.82)
Control	—	9.68 (2.83)	11.79 (4.17)	12.61 (4.77)	14.56 (6.32)	14.76 (6.49)	7.13 1.54)	10.30 (3.12)	11.64 (4.07)	13.09 (5.13)	13.71 (5.62)
S. Em. ±		3.12	2.92	2.81	2.72	3.05	2.77	3.23	2.94	3.11	2.80
C. D. at 5%		8.66	8.08	7.80	7.54	8.47	7.69	8.94	8.14	8.62	7.76
C. V. %		15.29	12.49	11.22	10.80	11.79	16.09	15.62	12.80	12.68	11.15

Figures in parentheses are retransformed values.

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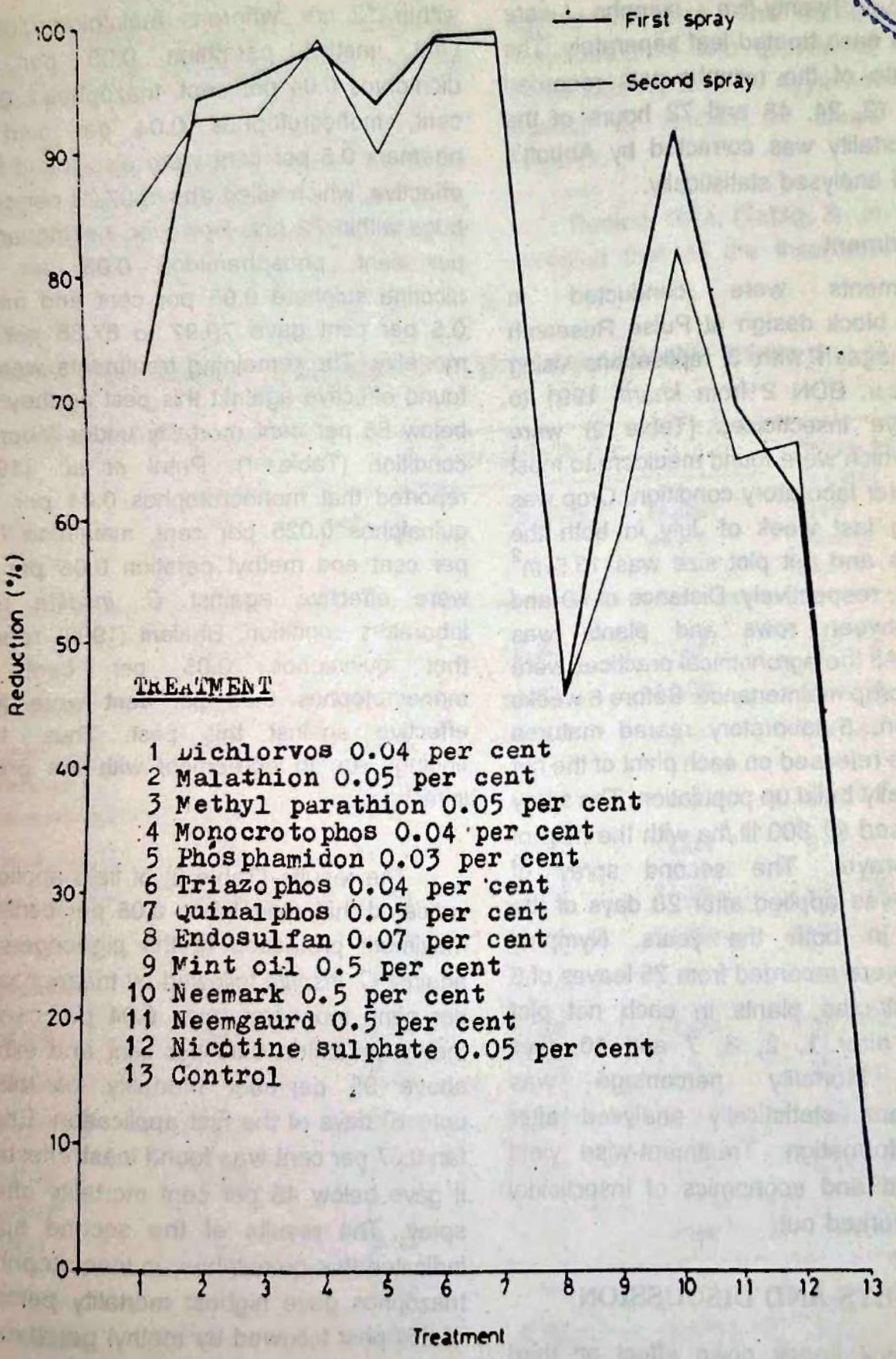


Fig. 1 : Pooled mean per cent reduction of C. insolita ten days after spraying of insecticides

temperature. Twenty-five nymphs were released on each treated leaf separately. The mortality rate of the nymphs was recorded after 3, 6, 12, 24, 48 and 72 hours of the release. Mortality was corrected by Abbott's formula and analysed statistically.

Field experiment

Experiments were conducted in randomised block design at Pulse Research Station, Junagadh with 3 replications using pigeonpea c.v. BDN 2 from *kharif*, 1991 to 1993. Twelve insecticides (Table 2) were evaluated, which were found mediocre to most effective under laboratory condition. Crop was sown during last week of July in both the years. Gross and net plot size was 13.5 m^2 and 4.86 m^2, respectively. Distance of 60 and 30 cm between rows and plants was maintained. All the agronomical practices were followed for crop maintenance. Before 6 weeks of application, 5 laboratory reared matured females were released on each plant of the net area for equally build up population. The spray liquid was used @ 800 lit./ha with the help of knapsac sprayer. The second spray of insecticides was applied after 20 days of the first spray in both the years. Nymphal populations were recorded from 75 leaves of 5 randomly selected plants in each net plot before and after 1, 2, 3, 7 and 10 days application. Mortality percentage was calculated and statistically analysed after arcsin transformation. Treatment-wise yield was recorded and economics of insecticidal treatments worked out.

RESULTS AND DISCUSSION

The quick knock down effect on third nymphal instar of *C. insolita* was obtained with the application of quinalphos 0.05 per cent, which registered 91.85 per cent mortality within 12 hrs, whereas malathion 0.05 per cent, methyl parathion 0.05 per cent, dichlorvos 0.04 per cent, triazophos 0.04 per cent, monocrotophos 0.04 per cent and neemark 0.5 per cent were also found highly effective, which killed above 97.23 per cent of bugs within 72 hrs. However, neemgaurd 0.5 per cent, phosphamidon 0.03 per cent, nicotine sulphate 0.05 per cent and mint oil 0.5 per cent gave 79.97 to 87.36 per cent mortality. The remaining treatments were not found effective against this pest as they gave below 65 per cent mortality under laboratory condition (Table 1). Patel *et al.*, (1985a) reported that monocrotophos 0.04 per cent, quinalphos 0.025 per cent, malathion 00.05 per cent and methyl paration 0.05 per cent were effective against *C. insolita* under laboratory condition. Bhalani (1990) reported that quinalphos 0.05 per cent and monocrotophos 0.05 per cent were found effective against this pest. Thus, these findings are in agreement with the present investigation.

The results (Table 2) of field application indicated that quinalphos 0.05 per cent gave maximum protection to the pigeonpea crop against *C. insolita* followed by triazophos 0.04 per cent, monocrotophos 0.04 per cent and methyl parathion 0.05 per cent and exhibited above 95 per cent mortality of this pest upto 10 days of the first application. Endosulfan 0.07 per cent was found least effective, as it gave below 45 per cent mortality after first spray. The results of the second spraying indicated that quinalphos, monocrotophos and triazophos gave highest mortality percentage of this pest followed by methyl parathion upto 10 days after application in second spraying too. Whereas, endosulfan and mint oil were observed least effective in controlling the pest

at all the intervals. The results are in confirmity with the results obtained in first spraying (Fig. 1).

Looking to the above results, it can be concluded that the quinalphos 0.05 per cent, triazophos 0.04 per cent and monocrotophos 0.04 per cent were found most effective against this pest. The maximum effect of monocrotophos and quinalphos @ 0.25 kg a.i./ha was reported by Ayyanna *et al.*, (1976) against *C. insolita* on brinjal in Andhra Pradesh.

Pooled data (Table 3) on grain yield revealed that all the insecticidal treatments

TABLE 3

Effect of insecticides on pigeonpea grain yield and avoidable losses due to mealybug, *C. insolita*.

Treatment	Concentration (%)	Grain yield (q/ha)			Increased in yield over control (%)	Avoidable loss (%)
		1991-92	1992-93	Pooled mean		
Dichlorvos	0.04	13.61	16.36	14.99	693.12	30.79
Malathion	0.05	14.57	12.52	13.55	616.93	37.44
Methyl parathion	0.05	14.95	18.83	16.89	793.65	22.02
Monocrotophos	0.04	16.17	23.15	19.67	940.74	9.18
Phosphamidon	0.03	13.99	15.29	14.64	674.60	32.41
Triazophos	0.04	16.80	25.93	21.36	1030.15	1.39
Qhinalphos	0.05	16.56	26.75	21.66	1046.03	0.00
Endosulfan	0.07	9.77	10.15	9.96	426.98	54.02
Mint oil	0.50	11.66	13.20	12.43	557.67	42.61
Neemark	0.50	15.09	16.15	15.62	726.46	27.89
Neemgaurd	0.50	12.76	13.79	13.27	602.12	38.73
Nicotine sulphate	0.05	11.83	14.37	13.10	593.12	39.52
Control	—	2.06	1.72	1.89	—	91.27
S. Em. ±	—	0.92	1.99	1.84		
C. D. at 5%		2.69	5.81	5.66		
C. V. %		12.22	21.54	18.48		

TABLE 4

Net realisation (Rs/ha), net profit (Rs/ha) and NICBR of insecticides sprays for the control of *C. insolita* in pigeonpea.

Insecticide	Concentration (%)	Quantity of insecticide required for two spraying (l/ha)	Total cost of treatments for two application (Rs/ha)	Grain yield of pigoenpea (q/ha)	Gross realisation (Rs/ha)	Net realisation (Rs/ha)	Net profit (Rs/ha)	Net incremental cost benefit ratio (NICBR)
Dichlorvos	0.04	0.843	352.00	14.99	11243	9825	9473	1:26.91
Malathion	0.05	1.600	344.00	13.55	10163	8745	8401	1:24.42
Methyl parathion	0.05	1.600	480.00	16.89	12668	11250	10770	1:22.44
Monocrotophos	0.04	1.600	576.00	19.67	14753	13335	12759	1:22.15
Phosphamidon	0.03	0.565	295.00	14.64	10980	9562	9267	1:31.41
Triazophos	0.04	1.600	744.00	21.36	16020	14602	13858	1:18.63
Quinalphos	0.05	3.200	952.00	21.66	16245	14827	13875	1:14.57
Endosulfan	0.07	3.200	728.00	9.96	7470	6052	5324	1:7.31
Mint oil	0.50	8.000	2520.00	12.43	9323	7905	5385	1:2.14
Neemak	0.50	8.000	1120.00	15.62	11715	10297	9177	1:8.19
Neemgaurd	0.50	8.000	976.00	13.27	9933	8535	7559	1:7.44
Nicotine sulphate	0.05	2.000	500.00	13.10	9825	8407	7907	1:15.81
Control	—	—	—	1.89	1418	—	—	—

Labour charges Rs. 20.00/labour/day. Market price of pigeonpea grains Rs. 750.00/q.

were significantly better than the control. The highest grain yield (21.66 q/ha)) was obtained in the plot sprayed with quinalphos followed by triazophos (21.26 q/ha), monocrotophos (19.67 q/ha) and methyl parathion (16.89 q/ha). Among the insecticidal treatments, the lowest grain yield (9.96 q/ha) was recorded from endosulfan treated plot.

The maximum percentage increase in grain yield was noted from the plot treated with quinalphos (1046.03 per cent) followed by triazophos (1030.15 per cent) and monocrotophos (940.74 per cent) over control (Table 3). However, the percentage of avoidable loss in yield was the lowest in treatment of triazophos (1.39 per cent) followed by monocrotophos (9.18 per cent), whereas in water sprayed pigeonpea plot, it was 91.27 per cent over maximum yield recorded with spray of quinalphos (Table 3).

The maximum NICBR is found in the sprays of phosphamidon followed by dichlorvos and malathion. Though, the highest net profit per hectare was recorded, when the crop was protected by quinalphos (Rs. 13875/-) followed by triazophos (Rs. 13858/-), monocrotophos (Rs. 12759/-) and methyl parathion (Rs. 10770/-) and they gave 1:14.57, 1:18.67, 1:22.15 and 1:24.42 NICBR, respectively. Thus, it can be inferred from these results that the insecticides, quinalphos, triazophos and monocrotophos were found to be the most effective and profitable against *C. insolita* on pigeonpea.

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