Generische Stellung: Die neue Art stimmt in allen wesentlichen Merkmalen mit *M. viciae Buckton*, dem Genotypus von *Megoura Buckton*, überein. Sie ist von dieser Art leicht zu unterscheiden durch die viel schwächere Pigmentierung. Kopf, Fühler, Pronotum, Beine, Siphonen und Cauda sind bei den Apteren von *M. viciae* schwarz, bei *M. litoralis* dagegen hellbraun. Die Anschwellung der Siphonen ist bei der neuen Art deutlich schwächer als bei dem Gattungstyp.

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Preliminary Studies on the Epidemiology of the Potato Aphids in West Bengal

(*Homoptera:Aphididae*)

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(With 1 figure)

Introduction

Aphids like *Myzus persicae* (*Sulz.*) are notorious vectors of potato viruses and are universally looked upon as potential menace to potato cultivations. However, they do not carry virus diseases unless they feed on diseased plants. The raising of disease free seed potatoes therefore, is of primary importance in preventing the outbreak of virus diseases. For successful growing of seed potatoes, the crop should be free from its virus vectors. This may be achieved by two ways; firstly, by direct insecticidal measures against the vectors and secondly, by the indirect way of avoiding them by growing seed potatoes in isolated areas, where the activity of the vectors is at a low ebb. For many reasons the first measure has not been found to be satisfactory. This is because insecticidal treatments cannot give absolute control of the insect vectors, particularly of the winged forms which, when disturbed, move from plant to plant and this increased activity results in the further spread of the disease. Moreover, continuous protection of the crop throughout the growing season is required to prevent the fresh inva-

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sions from untreated sources and is therefore, hardly practicable. The second measure, on the other hand, has been proved to be much more effective and its utility is now universally recognised. But intensive studies on the epidemiology of the aphid vectors are essential to adopt such a measure.

Little work has been done in India in this line. CHAUDHURI (1955) made some interesting observations during his studies on the epidemiology of *M. persicae* in Bihar, Uttar Pradesh and the Punjab, during 1952/53. He observed that the population of *M. persicae* was smaller in Bihar than those in Uttar Pradesh and the Punjab. Moreover, the infestation of *M. persicae* started earlier and persisted longer in the potato fields of Uttar Pradesh and the Punjab than in Bihar. He concluded that it is one of the main reasons why the seed stock of Bihar is comparatively disease free.

The present authors (BANERJEE & BASU, 1955) recorded *M. persicae* on potato and several other host plants in West Bengal. The presence of this notorious species led the authors to undertake studies on their relative abundance on potato crop in different regions of West Bengal, their host plants at different times of the year, their biology and migration etc. Besides *M. persicae*, *Aphis gossypii Glover* is the only species of aphid that has been observed so far, to infest potato plants in West Bengal. The present account deals with the authors' intensive observations on the population of aphids in a potato field near Calcutta, during 1955/56. A list of host plants of the potato aphids and short notes on their seasonal activities are also appended herewith.

Various methods have been followed by different workers for the estimation of aphid populations in the potato fields. DAVIES (1934), a pioneer worker in this line, counted the number of aphids on 100 lower leaves, chosen at random and expressed population as aphids per 100 leaves. Most of the later workers followed Davies' method with modifications in sampling leaves for aphid counts but they continued to express the population as aphids per 100 leaves. Others followed different sampling techniques and expressed the population as aphids per 48 leaves, aphids per plant and aphids per unit area. BROADBENT (1948) reviewed the different methods of recording aphid populations and concluded that for virus studies, the number of aphids per plant was perhaps the most useful estimate. BRADLEY (1952) also shared the same opinion. In the present investigation, the method suggested by BROADBENT (1948), has been followed.

Two species of aphids namely, *M. persicae* and *A. gossypii* have been noted so far to infest potato crop in West Bengal. Both the species are highly polyphagous and their host plants are given below.

M. persicae (*Sulz.*) — Potato (*Solanum tuberosum*), brinjal (*S. melongena*), tobacco (*Nicotiana tabacum*), mustard (*Brassica* spp.), radish (*Raphanus sativus*), cabbage, cauliflower, kohl-rabi (*Brassica oleracea*), turnip (*B. campestris*). tomato (*Lycopersicum esculentum*), coriander (*Coriandrum sativum*), sesamum (*Sesamum indicum*), datura (*Datura* sp.), pink (*Dianthus* sp.) and hollyhock (*Althaea rosea*).

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A. gossypii Glover. — Cotton (*Gassypium* spp.), lady's finger (*Hibiscus esculentus*), China rose (*H. rosa-sinensis*), bottle gourd (*Lagenaria vulgaris*), bitter gourd (*Momordica charantia*), ribbed gourd (*Luffa acutangula*), pumpkin etc. (*Cucurbita maxima, C. pepo, C. moschata*), cucumber (*Cucumis sativus*), melons (*C. melo*), water melon (*Citrullus vulgaris*), snake gourd (*Trichosanthes anguina*), *T. dioica*, potato (*Solanum tuberosum*), brinjal (*S. melongena*), black nightshade (*S. nigrum*), *S. xanthocarpum*, chillie (*Capsicum* spp.), bean (*Dolichos lablab*), *Colocasia* sp., *Canna* sp., guava (*Psidium guyava*), hedge (*Duranta plumeri*), *Ageratum conyzoides*, *Lantana camara*, hollyhock (*Althaea rosea*), *Celosia argentina*, *Cestrum* sp. and *Clerodendron infortunatum*.

In West Bengal, the aphids reproduce entirely by parthenogenesis. Oviparous females or males have not yet been observed. In the plains, *A. gossypii* is commonly found throughout the year and thrives on a wide range of host plants, particularly on Cucurbitaceae. *M. persicae* has been noted to appear in the second week of September on radish and later infests other crops. Until the sowing of potato, the Cruciferous crops mainly serve as their hosts. *M. persicae* remains fairly active upto the middle of March and small populations have been observed to persist upto the middle of April. Their activity during late summer and monsoon is under investigation.

Material and Methods

The present investigations were conducted in a farm near Calcutta. Regular observations on the populations of aphids were maintained throughout the growing season of the potato crop on a plot of land measuring about one-tenth of an acre. The crop was sown in the first week of December and the first count of aphids was made in the last week of December. Altogether, nine counts were made at weekly intervals, the last being taken two weeks before harvest. The counts were made in the morning.

To estimate the population of aphids, the method suggested by Broadbent (1948), was followed. According to this method, 40 plants from the experimental plot were selected at random and from each of them one upper, one middle and one lower leaf were taken and the average population of each level was calculated. The total number of leaves of every alternate of the forty selected plants were counted and the leaves were classified as upper, middle and lower. This classification was made by dividing the main shoot into three approximately equal portions. The leaves on the axillary shoots were counted as upper, middle or lower, according to the positions of the axillary shoots on the main shoot. The average number of upper, middle and lower leaves per plant was worked out. The number of aphids per plant was estimated by the formula:

$$\frac{1}{N}\{\bar{r}_1 \Sigma x_1 + \bar{r}_2 \Sigma x_2 + \bar{r}_3 \Sigma x_3\},$$ (Anascombe, 1948), where N is the number of plants examined, $\bar{r}_1$, $\bar{r}_2$, $\bar{r}_3$ are the average numbers of upper, middle and lower leaves per plant and x_1, x_2, x_3 are the number of aphids noted on a selected upper, middle and lower leaves of each plant. This method of counting has the advantage that it gives a fair idea of the population of aphids at different levels of the plant body. Weather records were maintained throughout the period of observation.

Findings

During the first two counts, the alate viviparous females and apterous nymphs were predominant and the apterous viviparous females were very few. Later, the alate viviparous females became scarce and the apterous viviparous females and the apterous nymphs mainly constituted the population.

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Table 1. Showing the average numbers of upper, middle & lower leaves per plant and the population at each level

Date	Average No. of leaves. Upper-Middle- Lower			Average population per plant							
				M. persicae				*A. gossypii*			
				U.	M.	L.	Total	U.	M.	L.	Total
30. 12. 55	13.8	21.7	6.0	1.0	1.6	0	2.6	2.0	13.5	0.1	15.6
6. 1. 56	14.1	24.2	7.7	6.9	14.6	3.4	24.9	1.4	30.2	3.0	34.6
13. 1. 56	15.5	25.4	12.5	6.9	16.5	12.5	35.9	0.7	30.4	11.2	42.3
20. 1. 56	21.7	37.9	15.1	14.1	12.3	22.6	49.0	2.7	33.1	31.7	67.5
27. 1. 56	28.7	64.2	38.5	6.4	70.6	30.8	107.8	7.8	113.9	134.7	256.4
3. 2. 56	29.3	67.6	31.4	33.6	300.8	81.6	416.0	17.5	496.8	254.3	768.6
10. 2. 56	30.4	75.1	32.2	39.5	279.7	71.6	390.8	9.8	206.5	127.1	343.4
17. 2. 56	35.0	94.0	38.2	7.0	89.3	41.0	137.3	4.3	178.6	21.0	203.9
25. 2. 56	34.0	59.2	19.4	0.0	0.0	2.4	2.4	0.0	8.8	0.0	8.8

The population of the alate nymphs was negligible in the first six counts but they appeared in greater numbers in later counts. This was true for both *M. persicae* and *A. gossypii*.

From Table I and Fig. 1, it will be evident that population of *A. gossypii* was higher than that of *M. persicae* almost troughout the period of observation. During the first four counts, the populations of both the species were found to rise gradually. In the fifth count a sharp rise in populations of both the species was noted which reached the maximum in the sixth count. This was the peak period

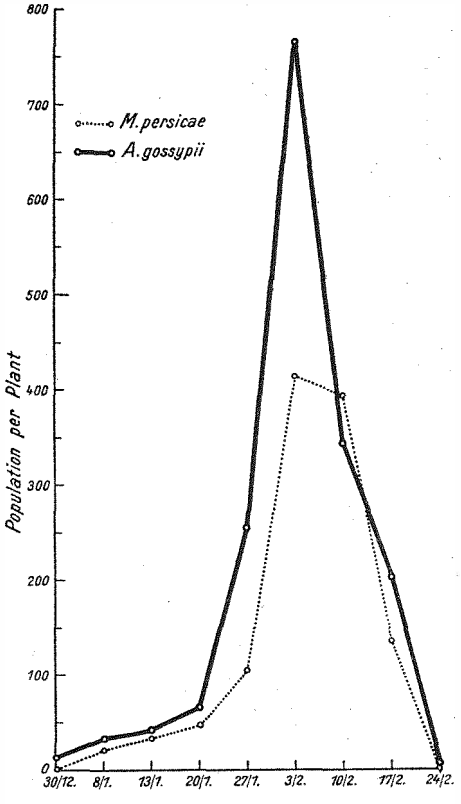

Fig. 1

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of infestation of both the species but the population of *A. gossypii* was almost double that of *M. persicae.* The population of *A. gossypii* however, fell abruptly in the next count and became less than half of that in the previous week. The population of M. *persicae*, on the other hand, remained more or less the same with only a slight reduction. The eighth count showed a notable reduction of both the species which ultimately became negligible in the last count, about two weeks before harvest.

Table I will also indicate that the population of *M. persicae* and *A. gossypii* was maximum in the middle leaves and least in the upper ones.

The weather condition during the last seven days previous to each counting date, have been summarised in Table 2.

Table 2. Showing the weather conditions of the last 7 days previous to each counting date

Period	Average temperature in °F.		Average % of Relative Humidity	Rainfall in inches
	Maximum	Minimum		
23. 12. 55—29. 12. 55	75.1	52.2	58.0	Nil
30. 12. 55— 5. 1. 56	76.7	51.0	68.8	Do
6. 1. 56—12. 1. 56	85.0	56.8	61.6	Do
13. 1. 56—19. 1. 56	81.1	55.0	66.0	Do
20. 1. 56—26. 1. 56	81.0	54.0	58.7	Do
27. 1. 56— 2. 2. 56	77.2	56.8	75.6	0.36
3. 2. 56— 9. 2. 56	71.4	54.2	63.2	0.83
10. 2. 56—16. 2. 56	82.4	53.4	61.7	Nil.
17. 2. 56—23. 2. 56	86.8	56.1	50.7	Do.

Discussion

The present investigation has revealed that the populations of *M. persicae* and *A. gossypii* on potato crop is fairly high in the neighbourhood of Calcutta. Their infestation was noted in the last week of December, when the plants were very young and persisted upto the end of February. It is obvious therefore, that the potato fields near Calcutta are subjected to the infestations of *M. persicae* and *A. gossypii* throughout the growing season of the crop. *A. gossypii* is abundantly found throughout the year on a wide range of host plants. *M. persicae* also usually appears in the field well ahead of the sowing of potato and is particularly abundant during January and February on various cultivated crops. Early sowing of potato in these areas, therefore, is not likely to be effective in escaping their infestations.

Some interesting observations have been made in connection with the populations of alatae and apterae at different stages of development of the crop. In the first two counts the alate viviparous females were predominant. It is obvious that they migrated from other sources and started the infestation. In later counts the apterous viviparous females and apterous nymphs formed the major portion of population and the alatae were scarce. Alate

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forms started to appear in greater numbers by the first week of February and later exceeded the population of apterae. This increased production of alate nymphs does not seem to be due to the weather conditions, as will be evident from Table 2. The assumptions is supported by the fact that the populations of alate nymphs of the two species on several other crops during the same period were appreciably lower than those on potato. RATTAN LAL (1955) demonstrated that gradual reduction of the water content of the mustard plants resulted in the progressive rise of the population of the alate *Rhopalosiphum pseudobrassicae* (*Davis*). He argued that the water content of the apterous forms is higher than that of the alatae and naturally the fall of water content of the host plant results in the production of increased numbers of alatae. The predominance of alatae of *A. gossypii* and *M. persicae* noted during the last three counts, seems to be due to the same reason. It will be evident from Table I, that the population of both the species reached the peak on 3rd February. The average maximum temperature during the previous seven days was 77.2° F, the average minimum temperature was 56.8° F, the relative humidity varied from 57% to 94% and the rainfall recorded was 0.36′. In the next count, taken on 10th February, the population of *A. gossypii* fell abruptly while the population of *M. persicae* showed a slight reduction. The average maximum temperature during the previous seven days was 71.4°F, the average minimum temperature was 54.2°F, the relative humidity varied from 53% to 94% and the rainfall recorded was 0.83″. The reduction of populations therefore, may hardly be attributed to the weather factors, as will be evident from the foregoing account. The fall of population seems to be due to the hardening of the foliage which resulted in the increased production of alatae. The alatae left the crop for suitable hosts and consequently the population went down. The peak period of infestation of the two species, therefore, largely depends on the condition of the crop.

Both *M. persicae* and *A. gossypii* were mainly noted on the middle and lower leaves. Insecticidal treatments therefore, should adequately cover the entire foliage for satisfactory control of the aphids.

Summary

M. persicae and *A. gossypii* are the two species of aphids which infest potato crop in West Bengal. Both the species are highly polyphagous and have a wide range of host plants. They infest the potato crop at the early stage of development and persist almost throughout the growing season of the crop. Potato fields nearabout Calcutta are therefore, subjected to the attack of the aphids throughout the growing season. Both the species are abundant before the sowing of potato, in areas near Calcutta. Early sowing of potato in these areas, therefore, is not likely to be effective in avoiding their infestations. The production of the alatae and the peak period of infestation seem to be largely dependant on the condition of the foliage. The aphids are not uniformly distributed on the potato foliage. They are particularly abundant on the middle and lower leaves and as such, insecticidal sprayings should adequately cover the entire foliage for satisfactory control of the aphids.

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Neue *Rhizoecus*-Arten aus Mitteleuropa

(*Homoptera* : *Coccoidea* : *Pseudococcidae*)

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(Mit 2 Textfiguren)

Nur zwei *Rhizoecus*-Arten kennen wir aus Deutschland im Freiland bisher mit Sicherheit: *Rhizoecus halophilus Hardy* und *R. albidus Goux.* Eine dritte Art, *R. falcifer Künck.*, wurde aus Gewächshäusern gemeldet. Alle weiteren Funde von *Rhizoecus*-Arten im Freiland und in Gewächshäusern Mitteleuropas sind wegen mangelhafter Bestimmung unsicher.

Verfasser konnte während der letzten Jahre in Süd- und Westdeutschland zwei neue *Rhizoecus*-Arten sammeln, die im folgenden beschrieben werden.

Rhizoecus caesii n. sp.

Weibchen (Holotypus Fig. 1 A—E): Körper langgestreckt, weißlich, mit relativ schwacher, pulveriger Wachsauflage. Körperlänge beim Holotypus etwa 1.35 mm, Breite ca. 0.65 mm.

Ventralseite: Antennen gekniet, 6-gliederig, mit längeren Borsten besetzt (Fig. 1 C). Formel nach der Länge der einzelnen Antennenglieder: 6, 1, 3, 2, 5, 4. Letztes Fühlerglied mit drei stärkeren, leicht nach innen gebogenen, stumpfen Sinnesborsten; vorletztes Antennenglied mit einer gleichartigen Borste. Oberseite des 2. Fühlergliedes mit kleinem, rundlichen Sinnesorgan. Länge der ganzen Antenne beim Holotypus etwa 0.15 mm. — Augen klein, Durchmesser etwa 8—9 μ, neben der Basis der Antennen. — Stigmen normal, hinteres Paar etwas stärker entwickelt. Umgebung der Stigmen ohne auffällige Drüsenansammlung. Beine relativ klein (Fig. 1 D), mit stärkeren Bor-

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